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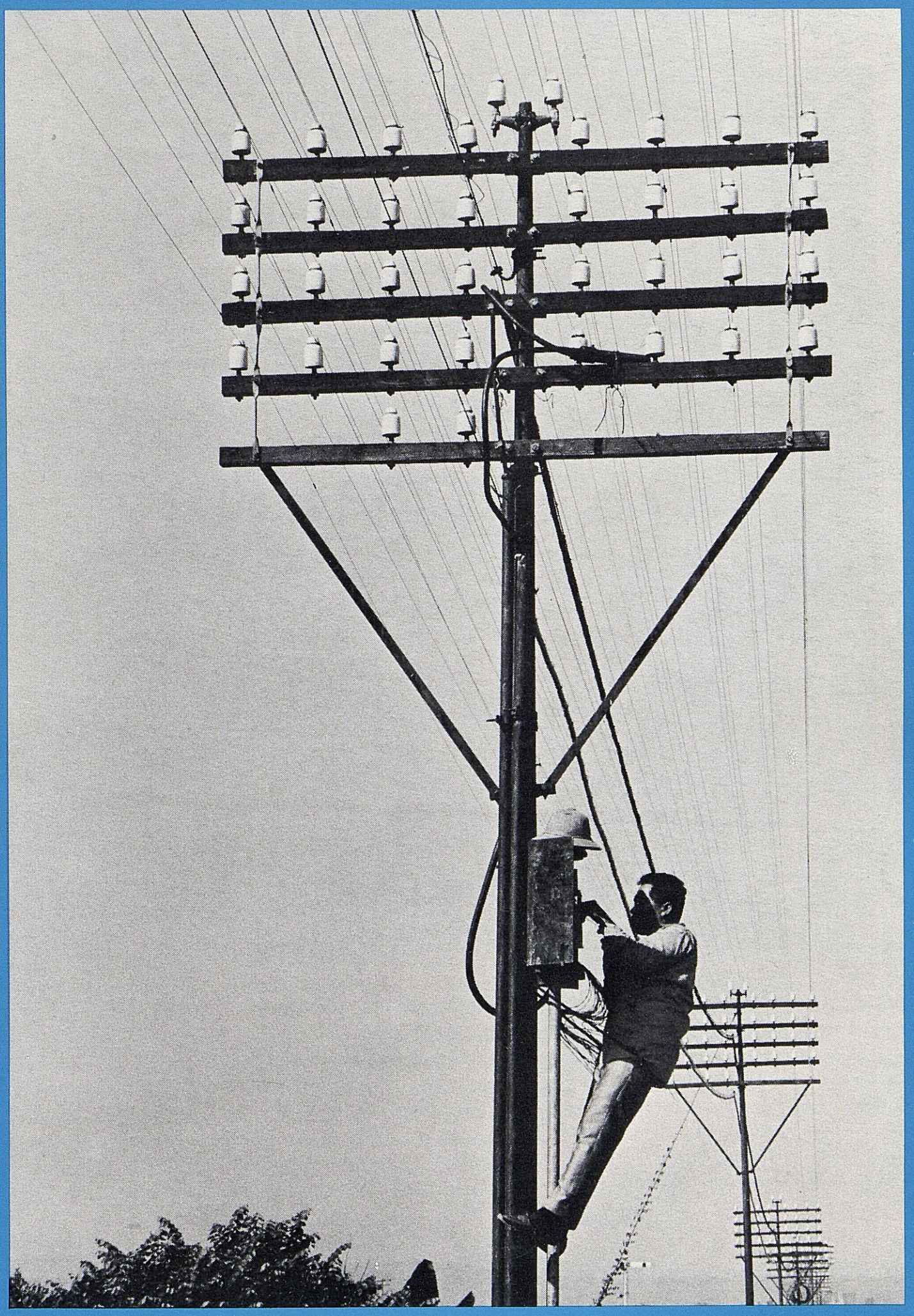
telecommunication journal

MONTHLY MAGAZINE OF THE INTERNATIONAL
TELECOMMUNICATION UNION — AUGUST 1971

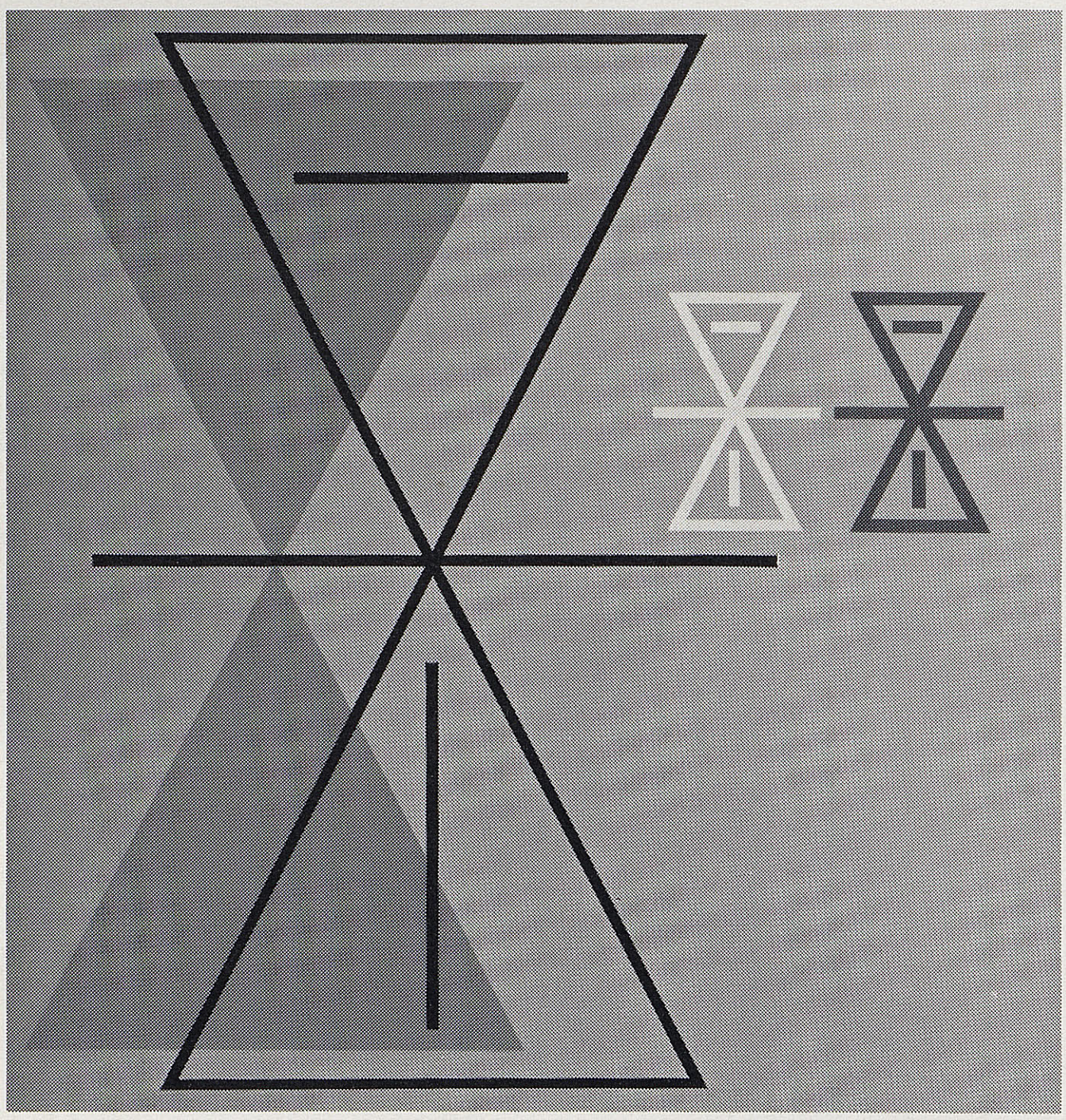


Information Distribution

PHILIPS

THE ECONOMIC USE OF
NEGATIVE IMPEDANCE REPEATERS ('NEGISTORS')
AND LOADING COILS
ON VOICE-FREQUENCY CABLES

VF Cable savings



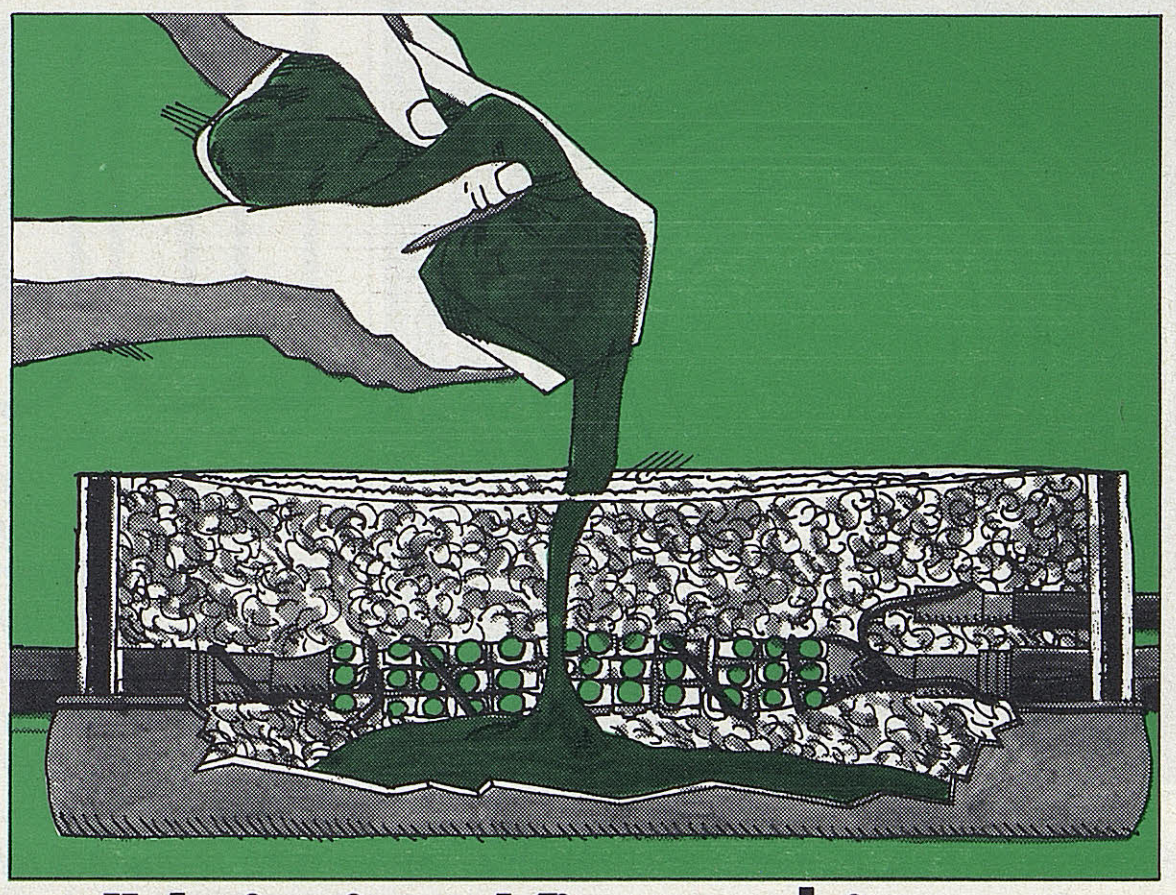
This detailed brochure is available on request
from N.V. Philips' Telecommunicatie Industrie.

N.V. Philips' Telecommunicatie Industrie, P.O.B. 32, Hilversum, The Netherlands

7057 E

3M

We've made a science of cable jointing.



"Scotchcast" Jointing Kits multi-purpose mold.

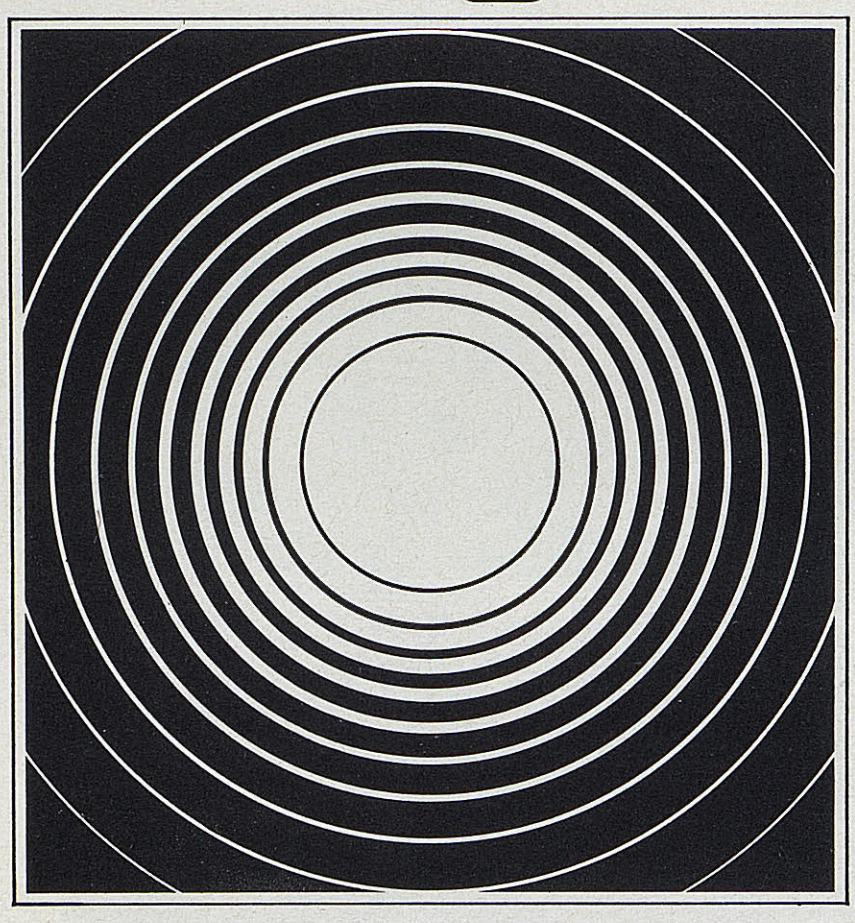
Just prepare the cable, wrap the mold around the joint and pour in the quick-hardening polyurethane compound. Versatile "Scotchcast" Kits do a swift, sure job on straight, bridge or tap joints, pressure blocks or sheath repair. Our exclusive "Unipak" container simplifies mixing and pouring the polyurethane compound. The result is a seal that protects dependably above or below ground and ends moisture problems even in buried plant.

The new "Scotchcast" Multi-Mold Splice Closure Kit 4502, shown above, handles conductor bundles up to 7.6 cm. Removable webbing sections let you tailor the mold to fit openings from 20.3 cm. to 43.2 cm. long to prevent wasting compound. Other "Scotchcast" Kits are designed for jointing, blocking and sealing jobs in a wide range of cable sizes.

3M has complete capabilities, plus tools and products to help you solve jointing, connecting, fastening and sealing problems. We have communication supplies and representatives in almost every country. For information and nearest address, write Minnesota Mining and Manufacturing Company, Electro-Products, International Division, P.O. Box 33800, Saint Paul, Minnesota 55113, U.S.A.

ARCHIVES
U.I.T.
GENÈVE

A pulse is a pulse, but



... yesterday there were 5 to 10 Morse pulses per second, today there are 2560000 PCM pulses.
HASLER is leading in the field of transmission systems using pulse modulation and carrier frequency techniques: pulse code modulation, carrier frequency telephony, power line carrier systems, high-frequency telephone broadcasting.
HASLER Ltd., Communications Engineering, Electronics and Precision Engineering; 3000 Berne 14, Switzerland; Belpstrasse 23, Tel. (031) 65 21 11.
Affiliate companies in Arnhem, Bad Homburg, Buenos Aires, Johannesburg, London, Madrid, Munich, Paris, Rio de Janeiro, Rome.

The HASLER PCM-67 System is a modern and reliable time division multiplex system for short- and medium-length transmission channels. It comprises: 30 voice channels according to CCITT recommendations, matching circuits for telephone subscribers and exchanges; data terminals for 50–200 Bd; 3 signalling paths per channel and direction; regenerators for cable transmission; 7 GHz transceivers for transmission via radio links.

HASLER PCM-67 systems – for cable and radio links – are operating successfully or are under construction in various European and South American countries. Does your communications network need expanding too? We shall be pleased to help you in your transmission problems.

Hasler

This year our bag is even bigger!

FREQUENCY BAND		CHANNEL CAPACITY					
	6/12 24/36/48	60/72	120	300	420/600	NEW! 960/1200	VIDEO
72 - 108 MHz 132 - 174 MHz 216 - 328 MHz	PT80 PT150 PT300 TR300	–	–	–	–	–	–
400 - 470 MHz	PT400/450 TR450	TR450					
890 - 960 MHz	SS900	SS900	SS900	NEW! –		–	–
1700 - 2300 MHz	TR2000	← SS2000W-02 → UP TO 125dB SYSTEM GAIN				–	–
2450 - 2500 MHz	TR2500	–	–	–	–	–	–
3700 - 4200 MHz	SS4000	SS4000	–	SS4000	SS4000	SS4000	SS4000
4400 - 5000 MHz	–	–	–	SS4500	SS4500	SS4500	SS4500
5945 - 6425 MHz	–	–	–	SS6000	SS6000	SS6000	SS6000
6575 - 6875 MHz	–	–	–	SS6000	SS6000	–	–
6875 - 7125 MHz	–	–	–	–	–	–	SS6000
7125 - 7750 MHz	–	–	–	SS7000	SS7000	SS7000	SS7000
10550 - 13250 MHz	–	–	–	SS12000	SS12000	SS12000 NEW!	SS12000

NEW!
FR2000 REPEATER FOR ALL 2 GHz SYSTEMS

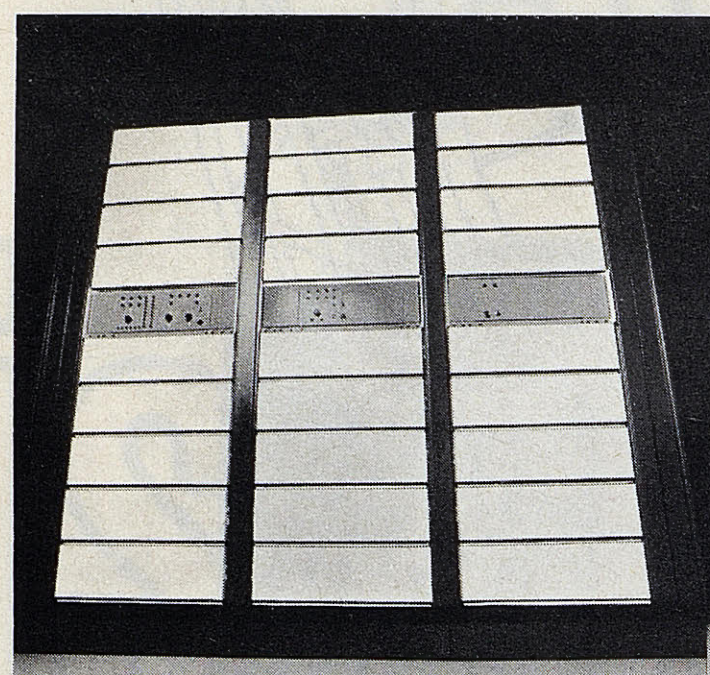
Farinon Electric, 935 Washington St.,
San Carlos, California 94070
(415) 593-8491

Farinon Miltech, 2995 Copper Road,
Santa Clara, California 95051
(408) 732-3921

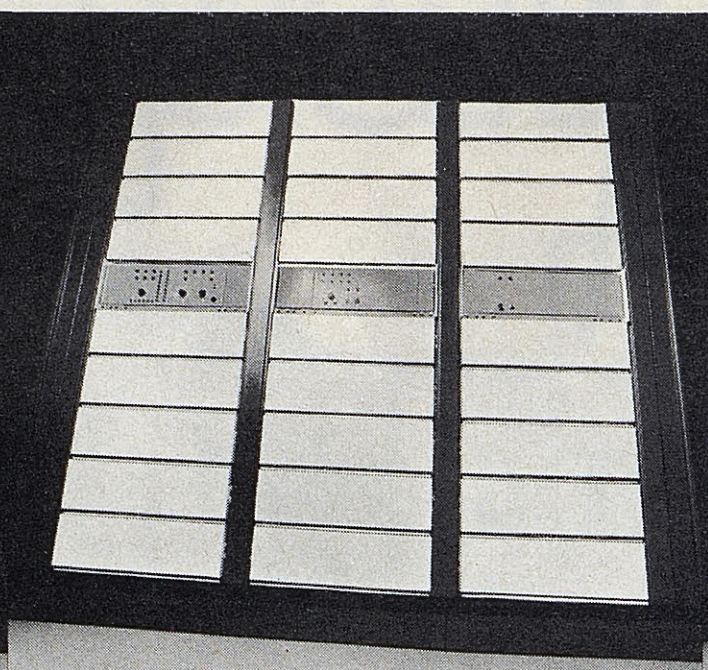
Farinon Electric of Canada, Ltd.

Farinon

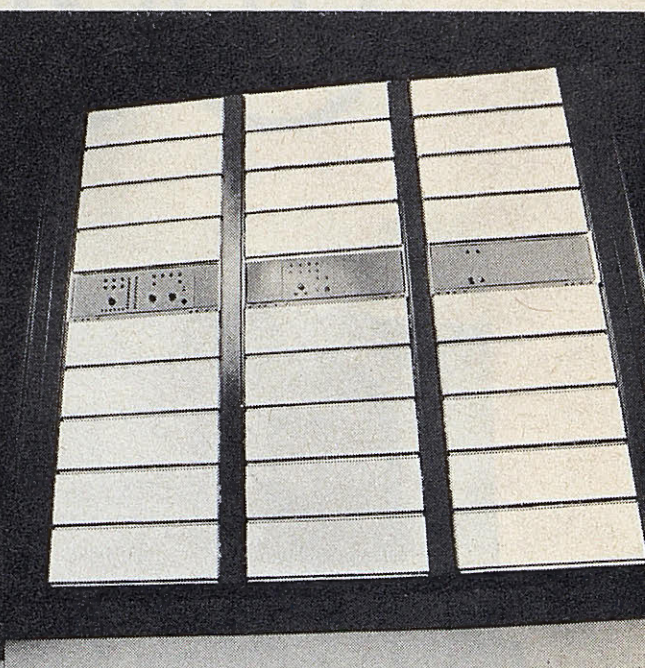
The many faces



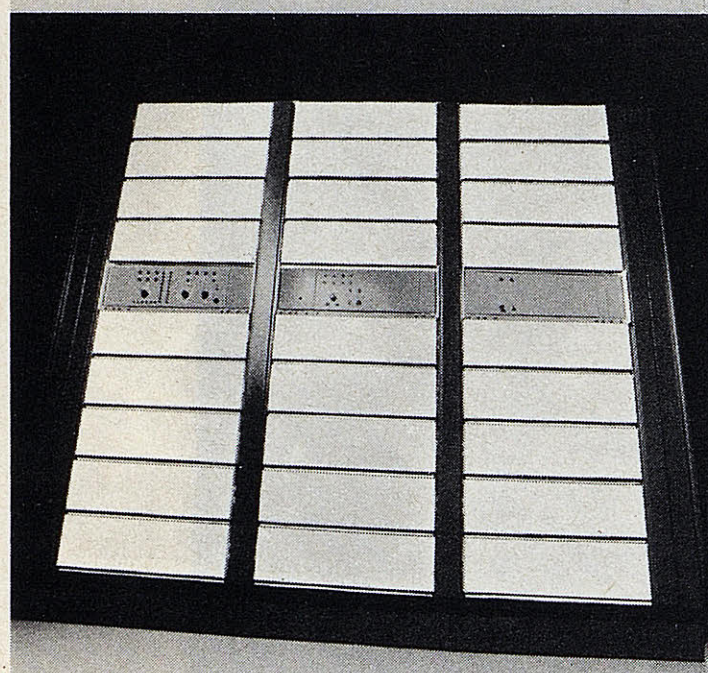
time saver



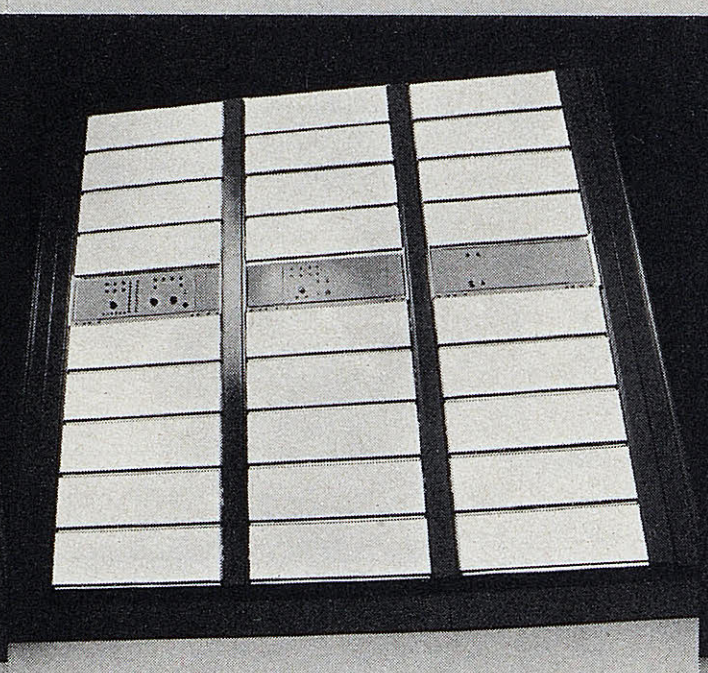
people chaser



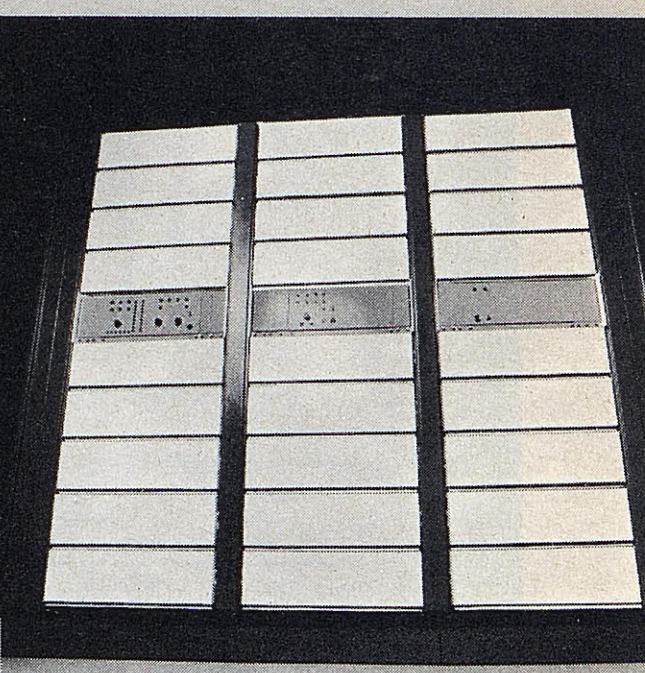
conference organiser



accountant



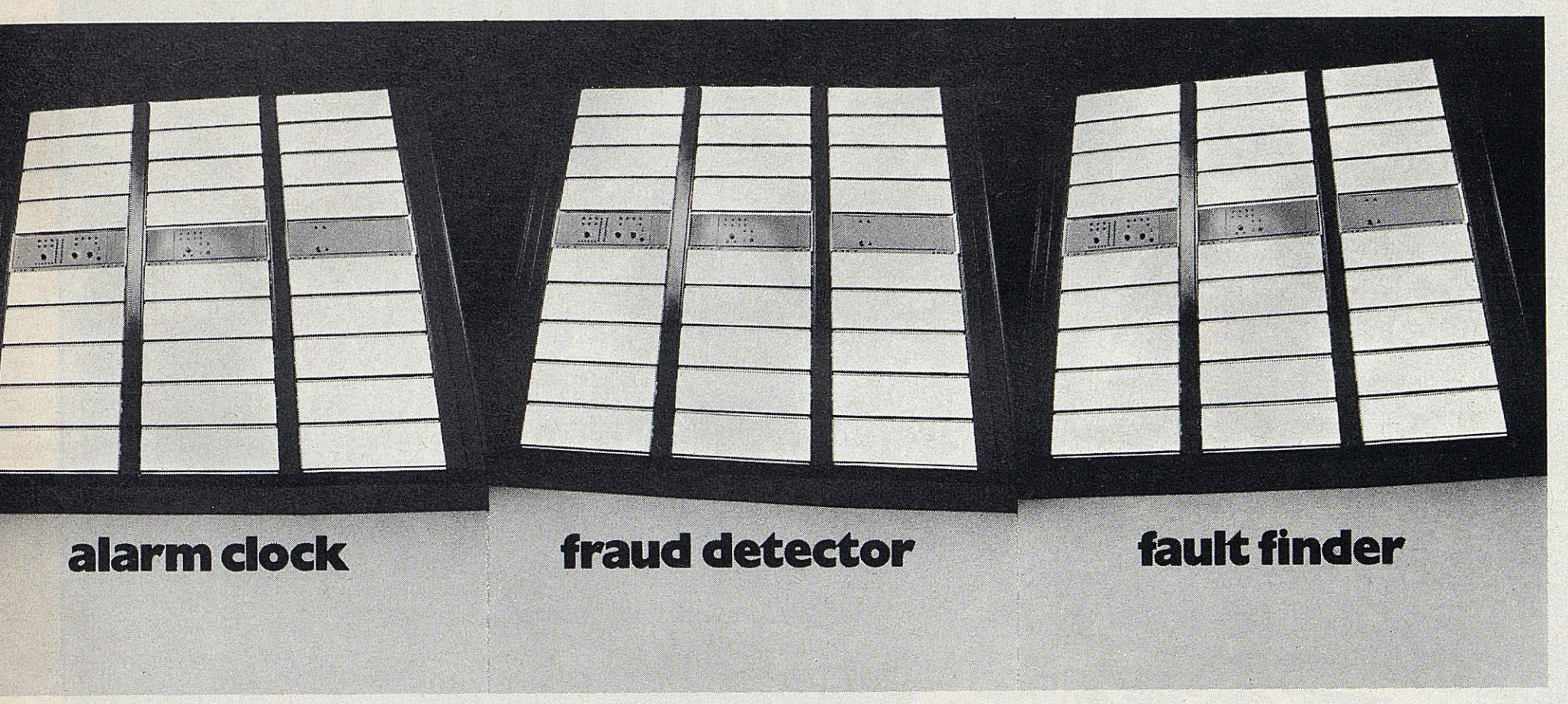
call re-router



space saver

*a Trademark of the ITT System.

# of Metaconta.



alarm clock **fraud detector** **fault finder**

Metaconta* is all these. And more. Despite its small size (only half that of existing exchanges) ITT's new electronic switching system provides all the most modern facilities for you and your subscribers.

How your subscribers benefit:

Metaconta gives them completely new facilities–like abbreviated dialling, call transfer and conference calls. Plus, of course, the features you'd expect. Push-button dialling, absentee service, alarm calls and call restriction. All automatic. All improving the service.

How you benefit:

Metaconta gives you centralised charging and recording, to simplify your accounting system. Automatic re-routing to avoid overloading of congested lines. And a centralised fault locator for easy observation, maintenance and service.

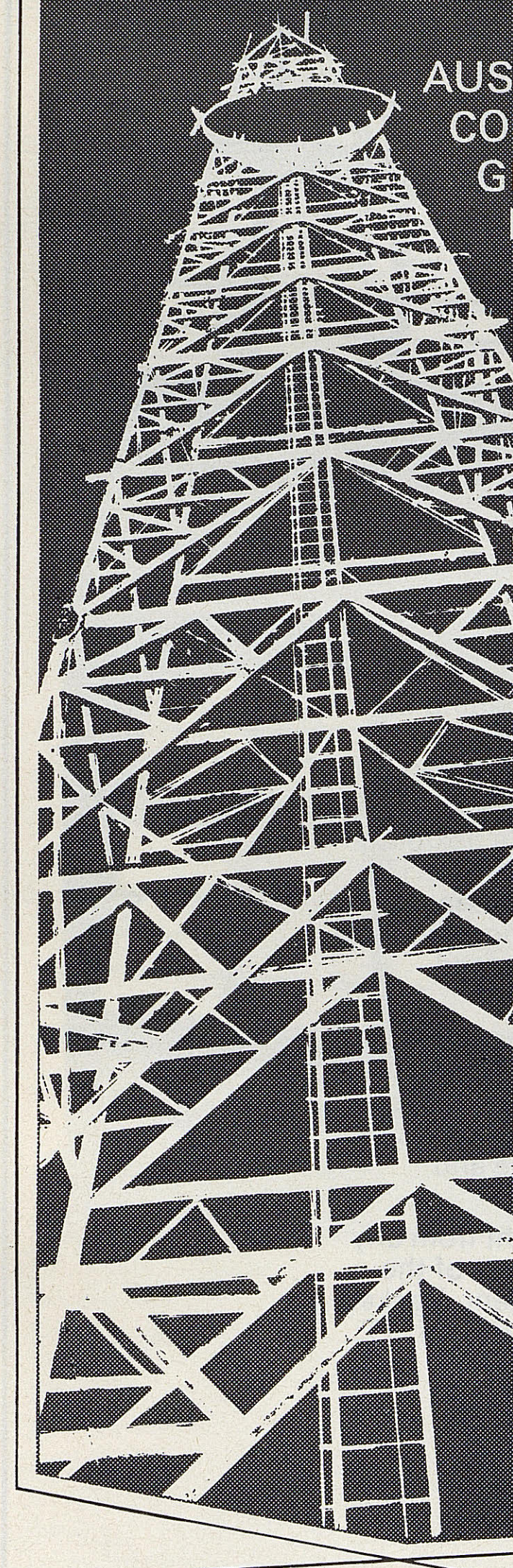
Much of Metaconta's flexibility derives from ITT processors–the ITT 3200 for high traffic exchanges and the ITT 1600 for low traffic–operating according to ITT's unique load sharing principle.

Metaconta's modular construction means easy on-site expansion. And utilizing Uniswep, ITT's new equipment practice, its design is extremely simple and compact.

Metaconta looks right from any angle: the switching system of the future at work in the present. Backed by the worldwide experience of ITT.

ITT

GEC links the world with microwave progress



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Broadband radio systems incorporating GEC microwave links are in operation in every continent in the world. The range of GEC microwave radio systems is impressive. It includes:-

- 2GHz, 4GHz, 6GHz and 6.8GHz equipments for speech or television on long haul main routes.
- 7.5GHz equipment for speech on medium haul spur routes.
- Associated equipments include F. D. Multiplex for up to 1800 circuits, supervisory alarm indication and remote control systems, I.F. and baseband switching equipments, narrowband auxiliary radio for serviceband antenna systems.

The achievement of GEC in the provision of microwave radio communication networks in so many countries of the world typifies their overall capability in telecommunications.

G.E.C.

Takes telecommunications into tomorrow

GEC-AEI TELECOMMUNICATIONS LTD, OF COVENTRY, ENGLAND.

A Management Company of The General Electric Co. Ltd. of England.

Con la energía "al momento" de Exide, Ud. obtiene servicio en cualquier momento.

El sistema continuo de Exide—cargador, baterías e inversor estático—es practicamente a prueba de fallas. Está siempre en operación, de modo que Ud. obtiene fuerza en Corriente Alterna sin interrupciones, bajas o fluctuaciones.

Si el inversor falla, nuestro Sistema Estático Reversor de Transferencia cambia la carga, automáticamente, a la línea de Corriente Alterna en menos de un cuarto de ciclo. Y nuestro Sistema de Transferencia Adelantada está listo para interferir en casos de cambios tan pequeños como una baja de corriente.

El sistema es tan seguro que Ud. casi no tiene que preocuparse por servicio. La razón de esto es que somos los líderes en el mundo en energía integral.

Es por esto que Ud. obtiene "servicio al momento" cuando compra la "carga al momento" de Exide. Dondequiera que Ud. se encuentre, hay personal de servicio listo para poner su experiencia y conocimientos a su servicio. Antes y después de la venta.

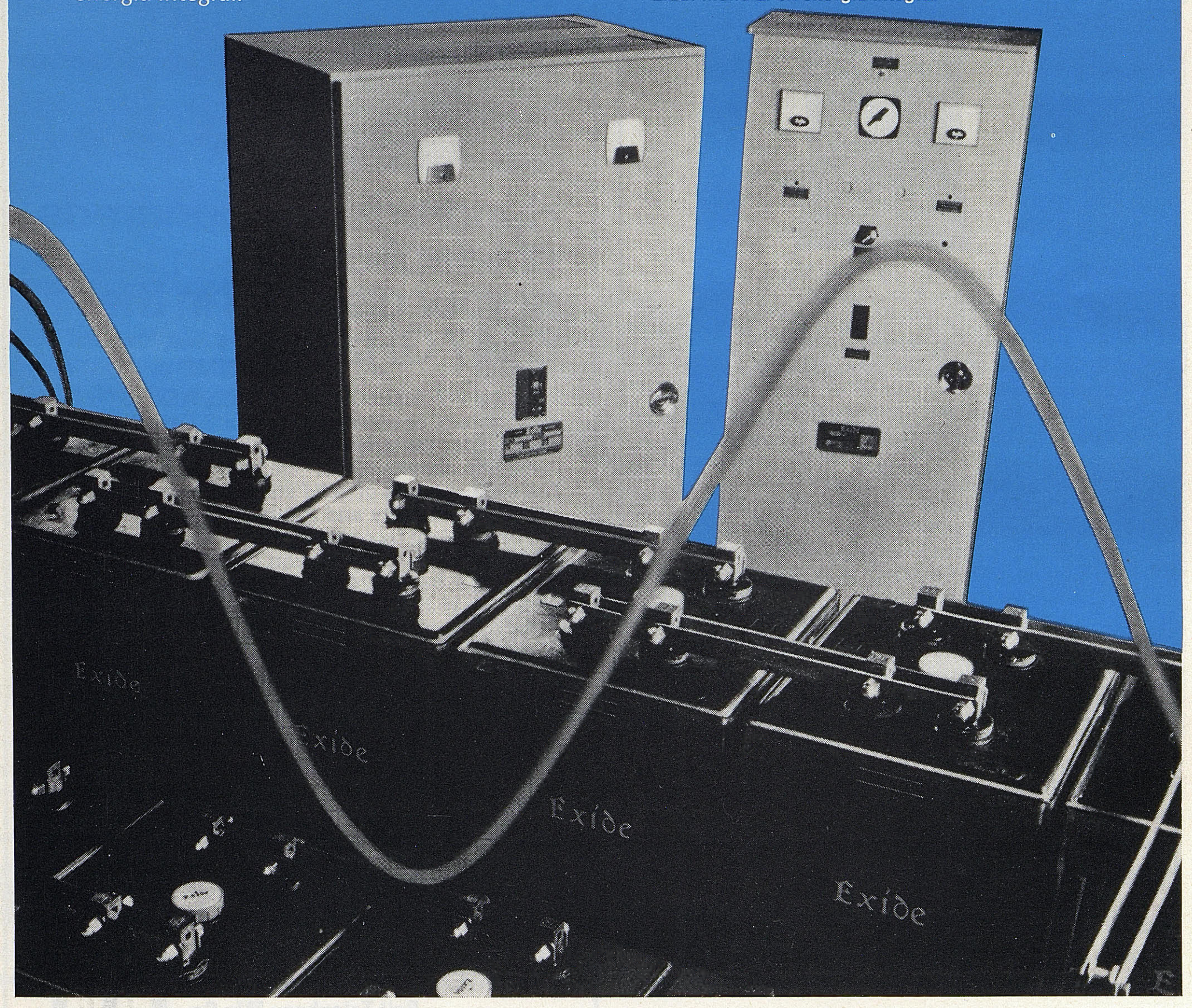
Para más detalles escriba a:

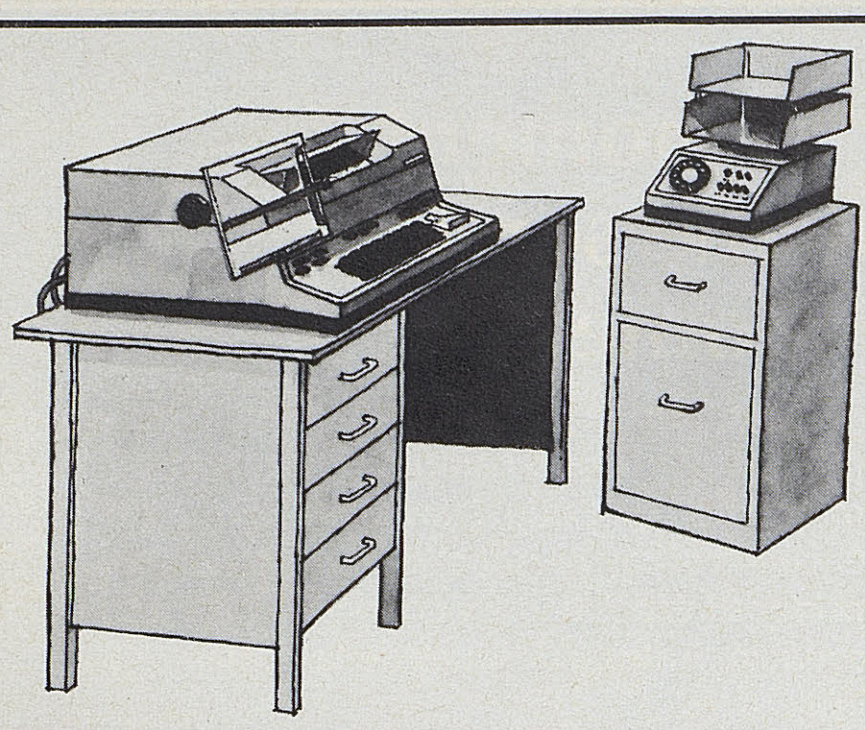
ESB INCORPORATED
International Group

12 South 12th Street.
Filadelfia, Pensilvania 19107, EE.UU. de A.

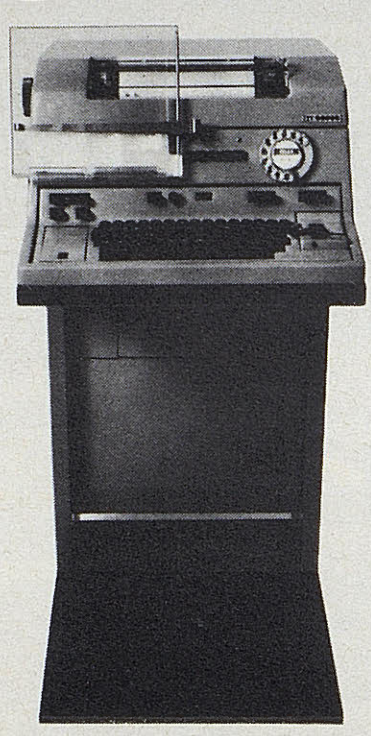
P.O. Box 8109, Philadelphia, Pennsylvania 19101, U.S.A.
Telephone: (215) LOcust 4-4030 Telex: 845-201
Cable: ESBCO, Philadelphia

Líder Mundial en energía integral





All together now.



The Creed 444 Integrated Telex Set is immaculately planned and styled – it's a real space and time saver.
Gone are the days when you had to have, side by side, a teleprinter on a desk, and a subscriber box. Mounted on a plinth, the 444 takes up less than half the floor space required for a desk-mounted installation.
And it's simple to operate – dial and controls face the operator and are easy to reach.
The subscriber unit is also accessible, making maintenance fast, cheap and convenient.
Robustly constructed and elegant in appearance, the 444 operates reliably and accurately for long periods.
Write for brochure on the 'Model 444 Teleprinter', 'Model 444 Technical Specification' and 'Model 444 Integrated Telex Set'.

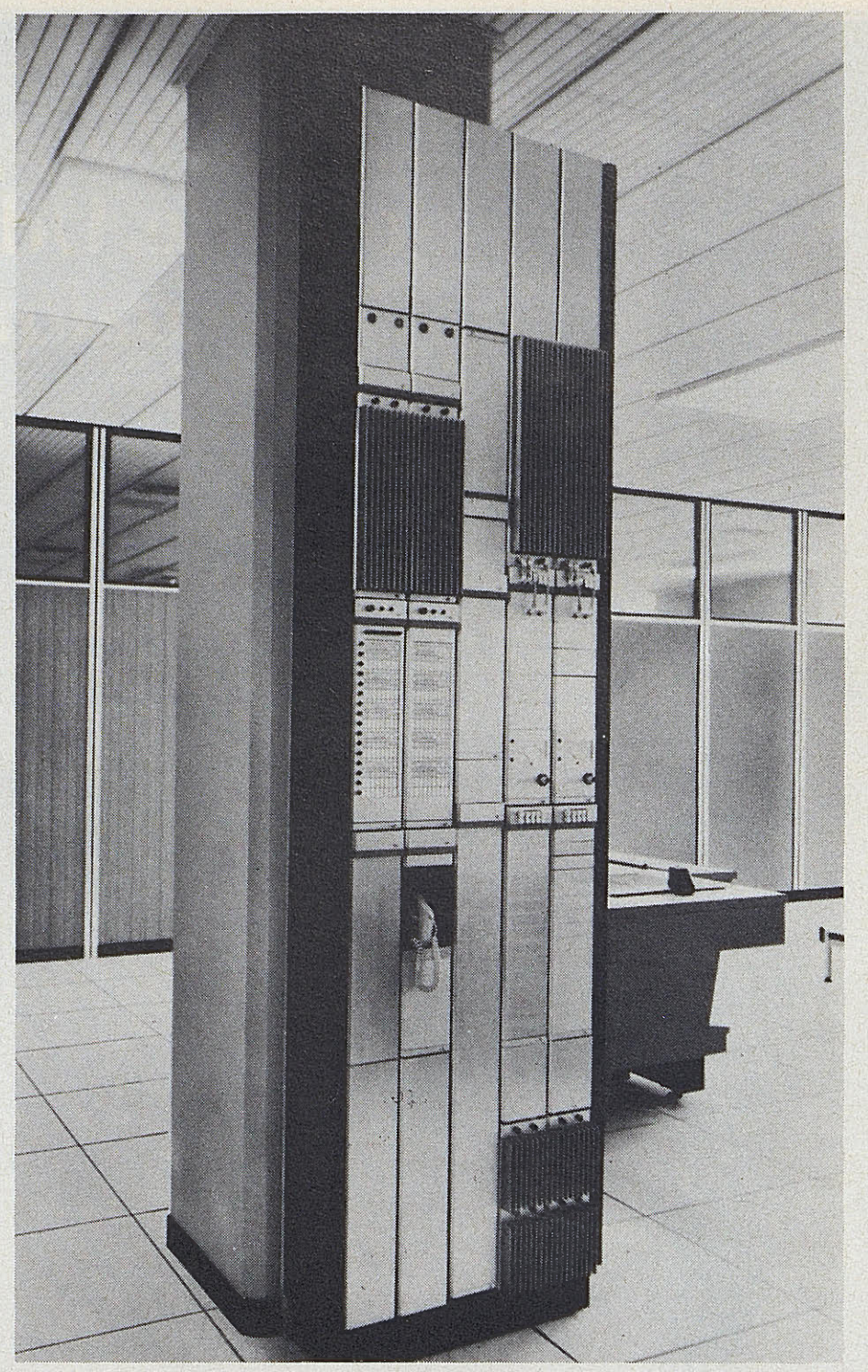
Public Relations Manager, ITT Creed,
Hollingbury, Brighton BNI 8AL, Sussex, England.
Phone: Brighton 507111 Telex: 87169.

NAME .....

ADDRESS .....

.....

117 **Creed & Company Limited** ITT



Hundreds and hundreds of telephone channels at your disposal in the 6 or 7 GHz band....

Now the FM 960/6000 or FM 960/7000 radio relay system, operating in the 6 or 7 GHz SHF band, provides for the transmission of 960 FDM telephone channels.
The exclusive use of solid state components gives increased reliability and a substantial reduction in size and weight by comparison, compared with other systems. Power consumption is kept extremely low: 3,4 A from a 24 V battery for a single both-way IF through repeater with a nominal RF output power of 2 watts.
Designed in a Vertical Standard Equipment Practice giving a high degree of flexibility in the installation and extension of a station (standard dimensions: 2600 mm × 121, 2 mm × 225 mm).
Auxiliaries, such as baseband switching, service channels, supervisory equipment and leak-insert facilities are available in this same practice.

For more details, please contact:
BELL TELEPHONE MFG Co.,
Radio and Line Transmission Division,
Jan Van Rijswijcklaan 162,
B-2020 Antwerpen, Belgium.

Bell Telephone Mfg Co ITT

Field-Strength Measurement

Rohde&Schwarz supply various field-strength meters, from compact field-strength indicators to measuring systems for absolute measurements. Special antennas, a panoramic adapter and a radio interference indicator complete the line of equipment.
All field-strength meters can be employed as test and monitoring receivers.
Complete field-strength test vans and radio monitoring vehicles equipped according to the customer's requirements are supplied.

Field-Strength Indicator for Rapid Surveying
Types HUZ and HUZE are compact units suitable for measurements under difficult conditions, where the accuracy of ± 6 dB (± 3 dB for relative measurements) is sufficient. Both sets are battery-operated. The antenna is supplied with the set.

HUZ: 47–225 MHz
Measurement range 1 μV/m–100 mV/m
Indication approximately logarithmic

HUZE: 470–850 MHz
Measurement range 27–110 dB above 1 μV/m
Indication approximately linear

Field-Strength Meter Type HFH 0.1–30 MHz
Measurement range 0–+120 dB above 1 μV/m
Linear indication range 20 dB,
logarithmic range 40/60 dB
Built-in standardizing oscillator, no correction chart necessary
Loop and rod antennas supplied with the set
AC supply or battery operation
Accuracy complying with CCIR

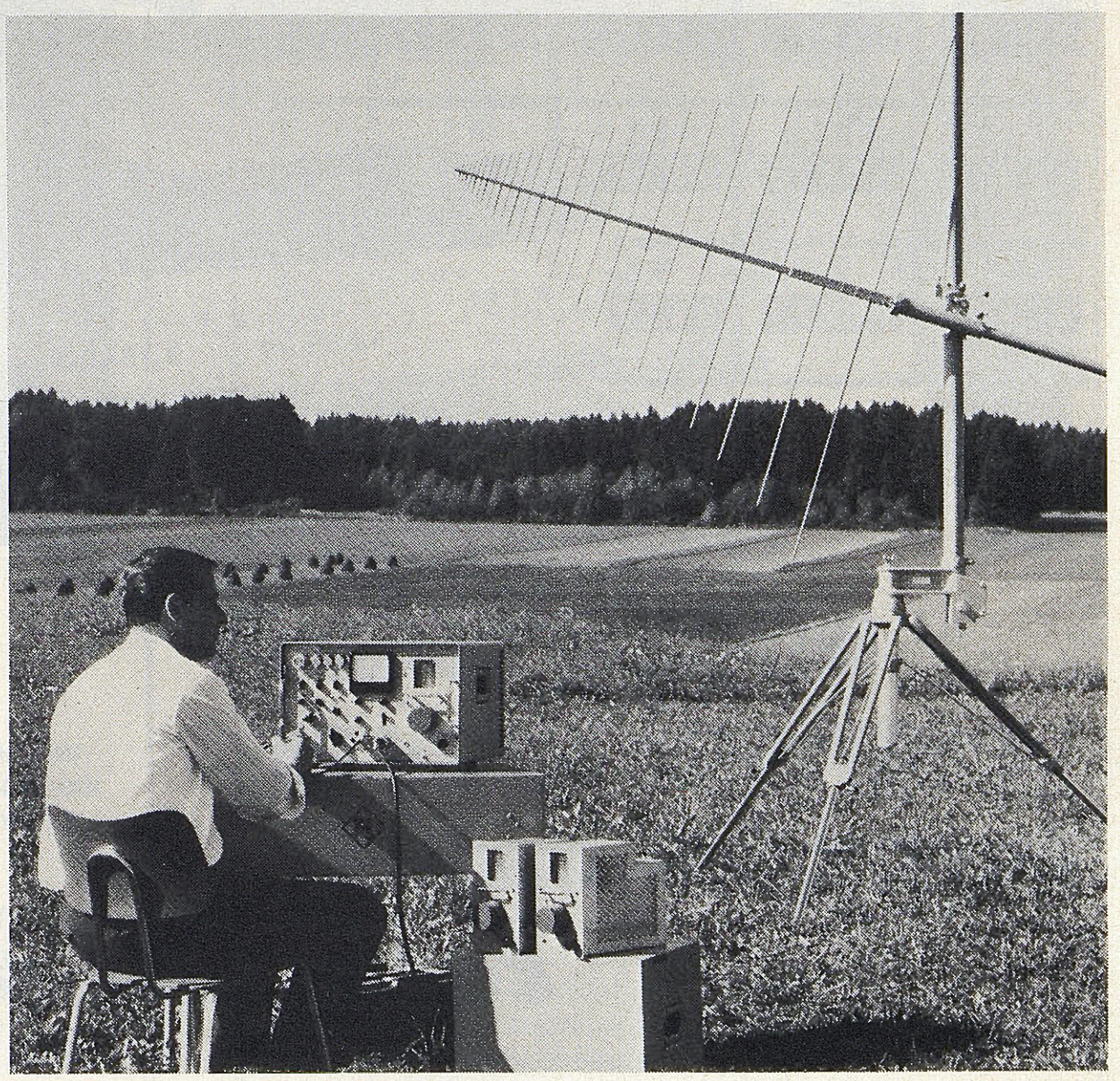
10–100-kHz Adapter Type HFHL
in conjunction with Type HFH enables voltage and field-strength measurements to be made in the frequency range 10–100 kHz with compensated antennas (no correction charts required).

VHF-UHF Field-Strength Meter Type HFU 25–1300 MHz
Complete test assembly for AM, FM and TV signals using broadband dipole for 25–80 MHz and log-periodic antenna for 80–1300 MHz. Measurement range 0–120 dB above 1 μV/m; switch-selected indication range: 20 dB linear or 40/60 dB logarithmic. Built-in standardizing oscillator for voltage calibration. Switch-selected average or peak-level (slide back) indication. BFO and automatic frequency control. AC supply or battery operation. Connection facility for analyzers, oscilloscopes and recorders.

VHF-UHF Test Receiver Type ESU
Same as HFU, but without antennas. Can be used as a selective microvoltmeter and, in conjunction with the built-in standardizing oscillator, for four-terminal network measurements.

Panoramic Adapter Type ESUP for spectrum observation near the carrier (± 500 kHz) in conjunction with Type HFU or ESU.

Radio Interference Indicator Type EZS
Measures interference field strength in conjunction with Type HFU or interference voltage in conjunction with ESU according to VDE 0876 and 0877 or CISPR rec.

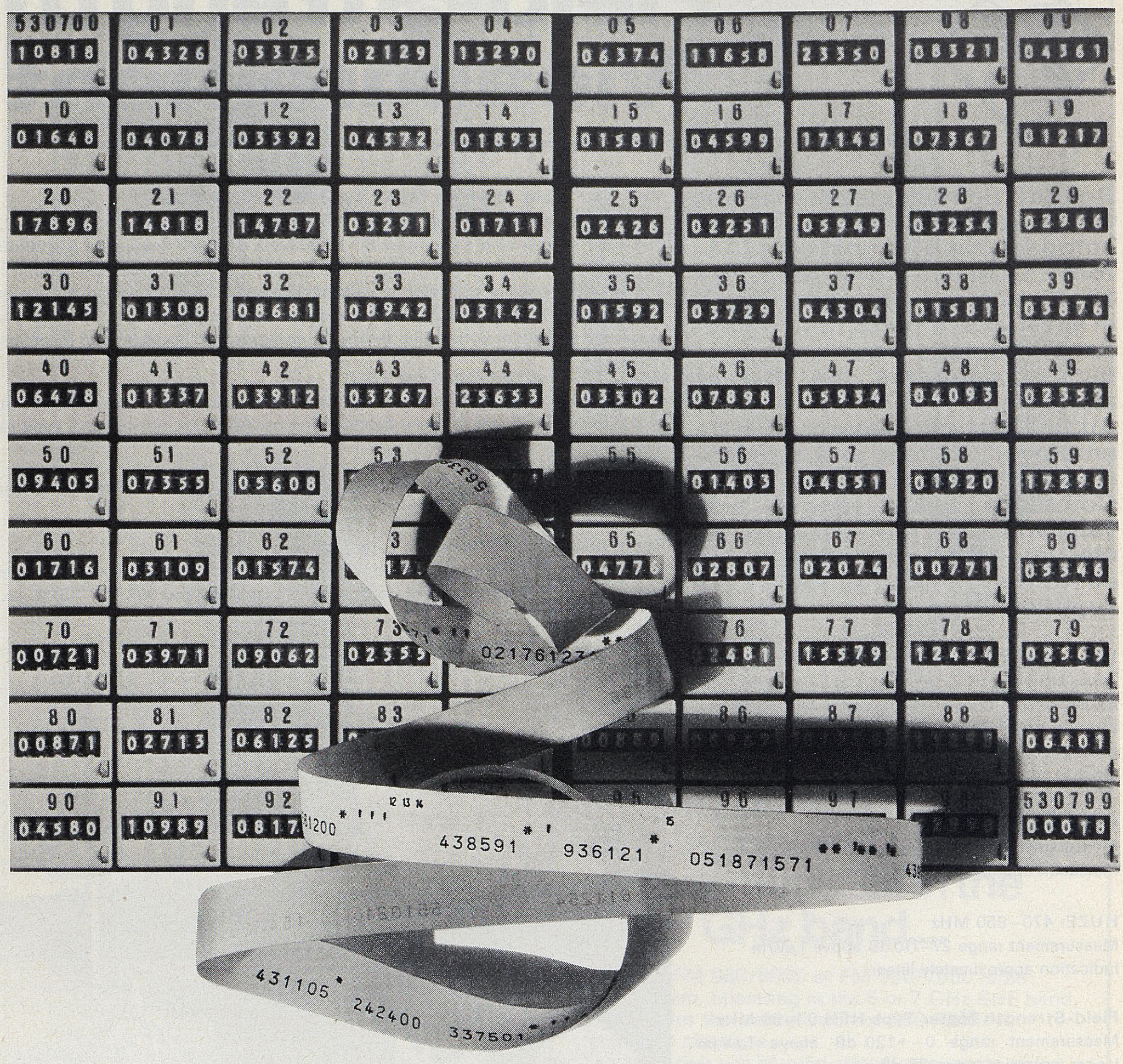


HFU in mobile use. Tripod with mast (height adjustable from 1.0 to 3.6 m), swivel arm and antenna support for log-periodic broadband antenna. The carrying case is used as table. At the centre: two plug-ins for other frequency ranges.

ROHDE & SCHWARZ

For further information write to Rohde & Schwarz (West Germany), 8000 München 80, Mühldorfstr. 15, Telex 05-23 703, or contact your nearest R & S distributor.

These figures don't say a thing



but this tape tells the whole story!

With the telephone charge analyser, charges for calls can be checked accurately by simply switching on the instrument at the exchange. The time of day, number dialled, number of chargeable pulses and the duration of the call are recorded on a paper tape. This information is essential to check a subscriber complaining about excessive telephone bills, counter maloperations and to trace a subscriber initiating malicious calls.

Zellweger USTER

Telefonografen Ltd., CH-8634 Hombrechtikon, Switzerland – A member of the Group Zellweger Uster

06.2.1 E

Listen.

STC headsets are light as a feather.
And beautifully comfortable to wear.
Hardwearing to the point of being indestructible.
Yet inexpensive.
So it's not surprising that PTT's the world over are using them.
When you want headsets, use ours.
You'll be glad you listened to us.
STC Subscriber Apparatus and Acoustic Division,
Standard Telephones and Cables Ltd,
Oakleigh Road, New Southgate,
London N.11.
Tel. No: 01-368 1234. Telex: 21917

Standard Telephones and Cables Limited

ITT

Our phone is your fortune.

Every Deltaphone your subscribers rent means more profit for you. And Deltaphone has a modern shape and comes in colours to blend with any colour-scheme.
That's why so many people want one.
There is no extra outside plant investment and maintenance is easy.
Let us help you make your fortune.
STC Subscriber Apparatus & Acoustic Division,
Standard Telephones and Cables Limited,
Oakleigh Road, New Southgate, London, N.11.
Tel No: 01-368 1234. Telex: 21917

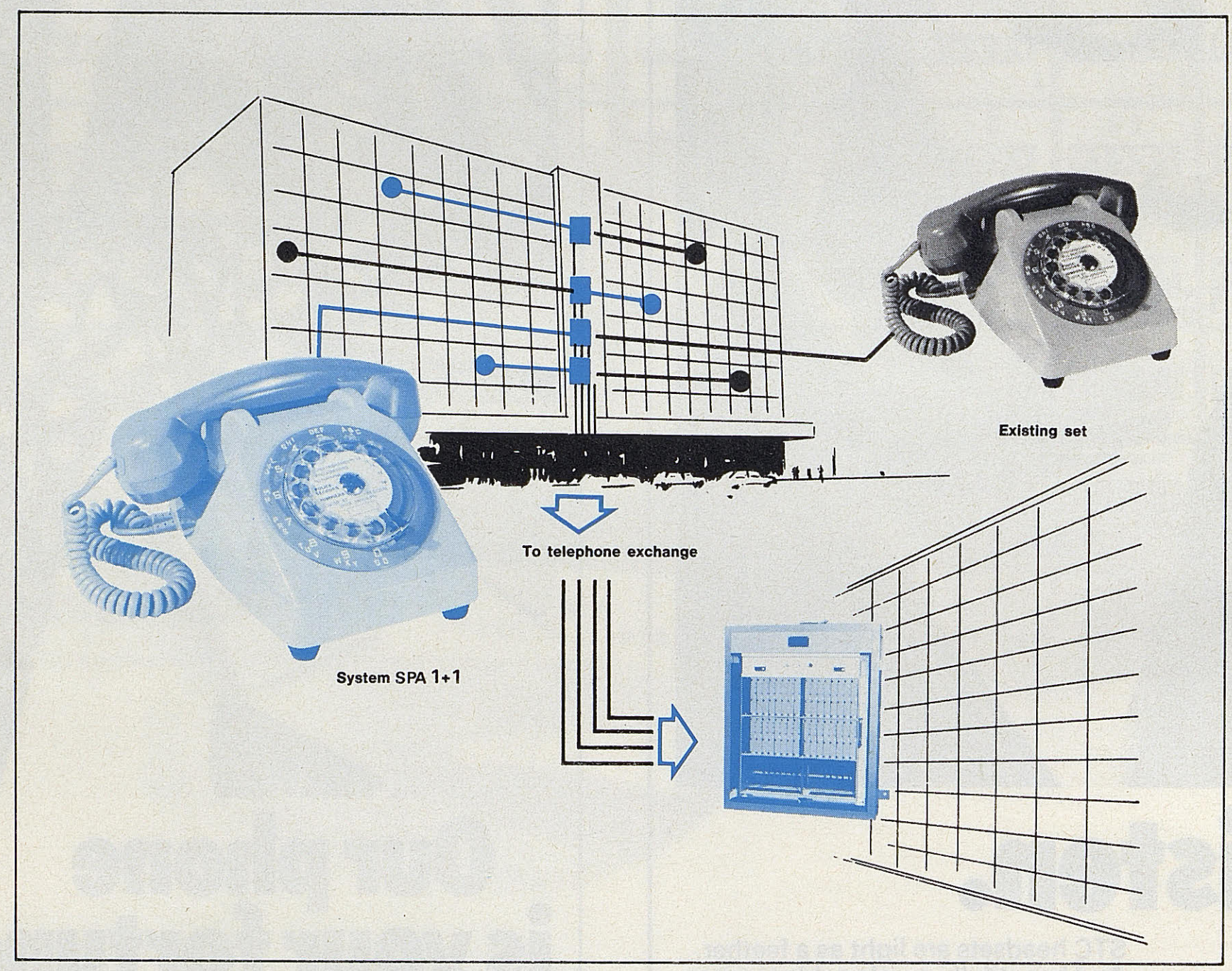
Standard Telephones and Cables Limited

ITT

TYPE SPA 1+1 CARRIER CURRENT SYSTEM
FOR SUBSCRIBER TELEPHONE LINE

The type SPA 1 + 1 carrier current system has been developed to satisfy rapidly the requirements of telephone connection between the user and the central exchange. An additional link can be established on each line connecting one subscriber telephone to the exchange. It is particularly interesting :

- ☐ when the maximum capability of the cable is reached
- ☐ when the length of the cable is such that the SPA 1 + 1 system is cheaper
- ☐ when temporary installation is urgently needed



ADVANTAGES

- ☐ total independence of the two users
- ☐ remote power-feeding of both sets from the exchange
- ☐ installation and utilization of the system without modifying existing equipment
- ☐ adaptability to all cables or open-wire lines
- ☐ low investment cost.

PVP 804

GROUPE CGE

COMPAGNIE INDUSTRIELLE
DES TÉLÉCOMMUNICATIONS CIT-ALCATEL
DÉPARTEMENT TRANSMISSION
33, Rue Emeriau - Paris 15e
Tél. 577-10-10 - Télex 25.927

SUBMARINE CABLE COMMUNICATIONS

120 channels 4 kHz or 160 channels 3 kHz
and 480 channels 4 kHz or 640 channels 3 kHz

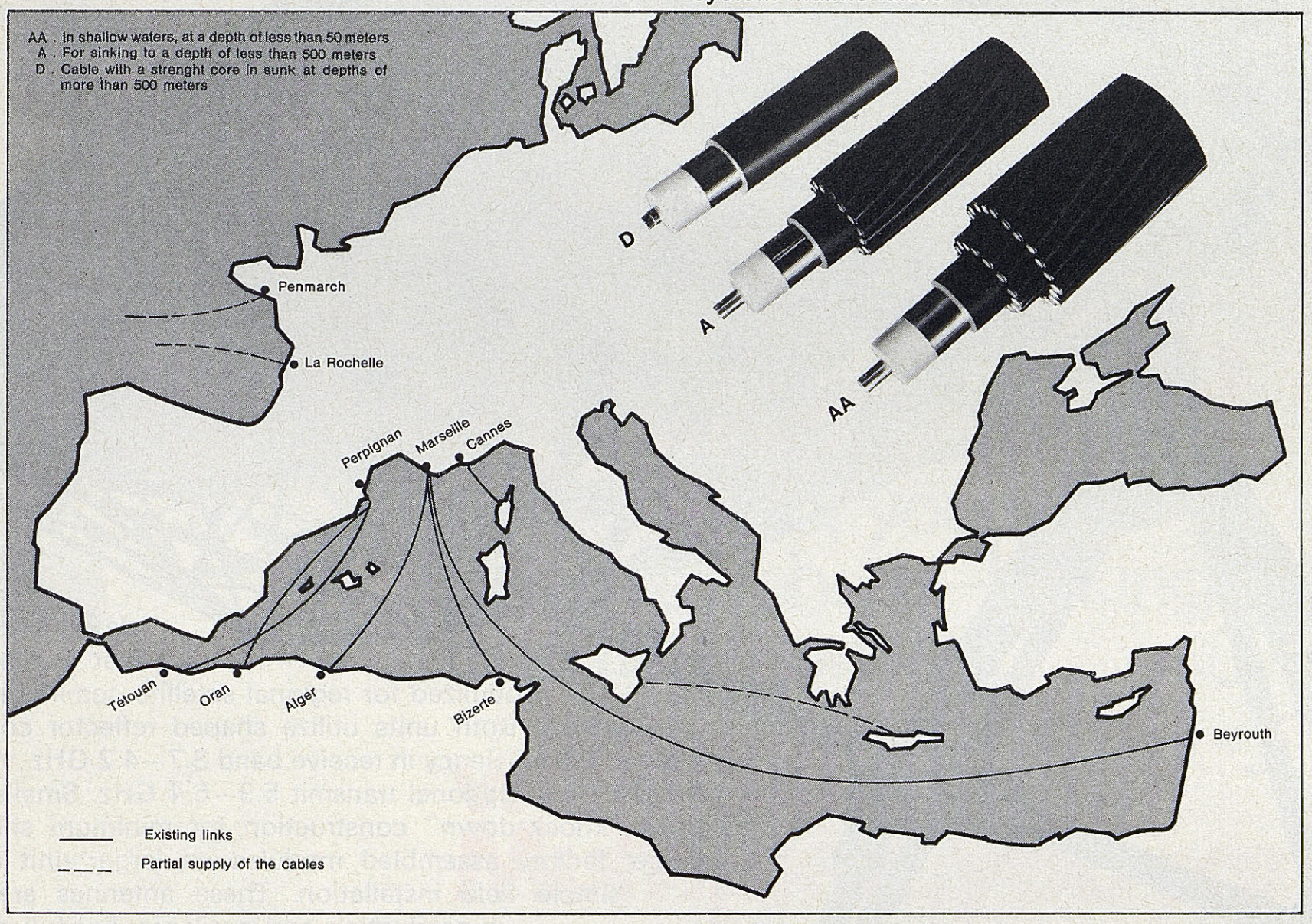
The Compagnie Générale d'Electricité manufactures complete submarine cable systems.

"All-in" CIT contracts cover :

☐ Costing, financement, and technical prospect studies

☐ Manufacture, laying and final commissioning of the system (including terminals)

☐ Assistance in staff training and subsequent system maintenance



The CGE systems include :

☐ Steel core coaxial cable
☐ Very high reliable solid-state equipment
☐ Rigid repeaters, with guaranteed longevity
☐ Remote powering facilities
☐ SMA7 type terminals and 12 or 16 channels base groups multiplex
☐ Computer is used for controlling and measuring each amplification unit.

Références :

Holland-Denmark, France-Algeria (Marseilles-Algiers and Perpignan-Oran), Cannes-Ile Rousse (Corsica), France-Morocco, France-Tunisia, France-Lebanon.

Important participation :

Sicily Crete, TAT II et TAT IV (France-U.S.A.)
TAT V (Spain-U.S.A.)

PVP 837

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Tél. 270-01-50 - Télex 62787

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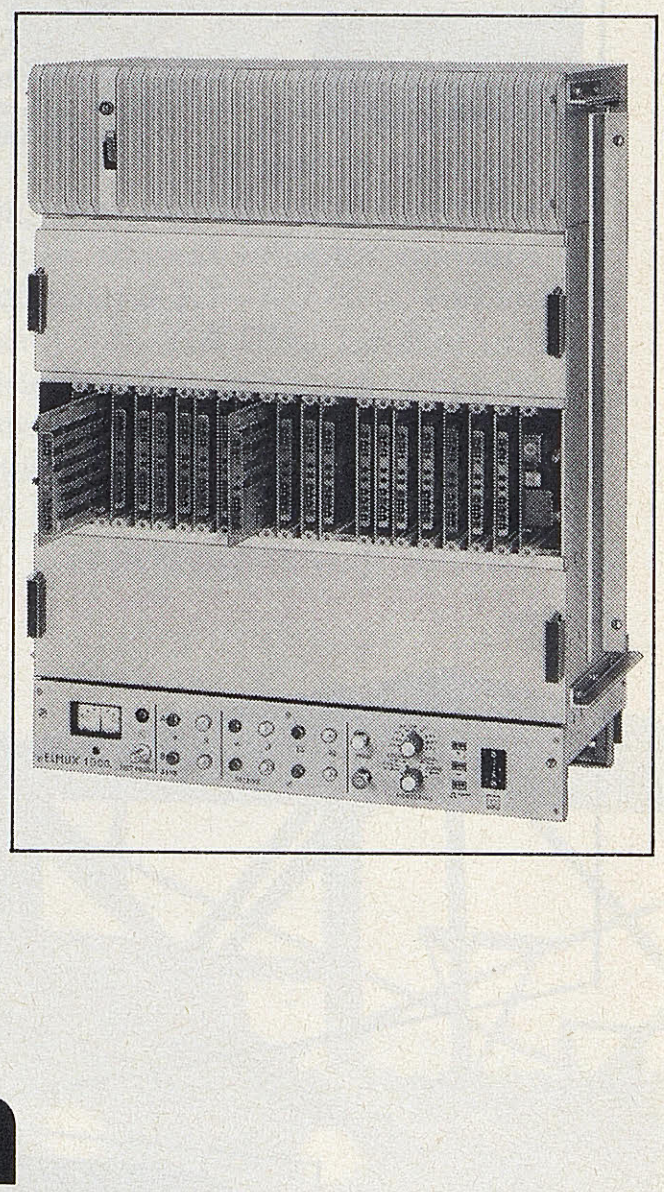

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Cover:

Trainees from the Telecommunication Training Centre in Kuala Lumpur (Malaysia) are seen here as they repair telephone lines along the road between Kuala Lumpur and the airport

(United Nations)

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editorial

Address delivered by Mr. M. Mili, Secretary-General of the ITU, at the inaugural meeting of the World Administrative Radio Conference for Space Telecommunications

Geneva, 7 June 1971

Mr. Chairman,

Mr. Federal Councillor,

Doctor Candau, representing H. E. U Thant, Secretary-General of the United Nations,

Executive Heads of the international organizations,

Representatives of the Cantonal and Municipal Authorities,

Your Excellencies,

Ladies and Gentlemen,

I should like first of all to thank Mr. Bonvin, Federal Councillor, for the remarkable speech he has just made and for the honour he does us in being present at this official opening meeting of the second World Administrative Radio Conference for Space Telecommunications. No one is more qualified than the Head of the Department of Transport, Communications and Power, who also is a good friend of the ITU, to address an important Conference organized by a specialized agency of the United Nations which for more than a century has enjoyed

the generous hospitality of his country and for more than a quarter of a century has chosen to have its headquarters in this beautiful city of Geneva.

I should also like to extend my warmest thanks to the Cantonal and Municipal Authorities for honouring this opening meeting by their presence.

We are deeply touched, too, by the kind words spoken by my old friend Dr. Candau, who was good enough to bring greetings and good wishes from all the international organizations members of the large family of the United Nations. It is a great pleasure for us that the Director-General of the World Health Organization has been able to attend this meeting and to transmit the message by the Secretary-General of the United Nations which so rightly stresses the importance of telecommunication in the world today.

In his remarkable message U Thant very aptly recalled the substance of the resolutions adopted by the United Nations General Assembly on space matters. As far back as 12 December 1959, these resolutions drew the world's attention to the problems posed by the advent of the space era and particularly to the role which the ITU must play in this field. No one knows better than he the heavy responsibilities that the Union must discharge towards all of the peoples of our planet.

I should like to ask Dr. Candau, on your behalf, to convey to the Secretary-General of the United Nations our warmest thanks for the encouraging message he was good enough to send us.

In fact, the ITU has discharged its responsibilities with competence, resolution and efficiency for more than a century. But at no time in its long history have these responsibilities emerged so clearly as with the advent of the space era.

Our position today could easily be likened to that of builders who must convert and enlarge a handsome well-constructed building in order to meet new requirements which are constantly increasing at bewildering speed, without being able to predict exactly what the future holds in store.

To realize how true this is we have only to consider the progress which has been achieved in space telecommunications since the first Space Conference in 1963.

I shall simply cite two significant examples to show how the progress accomplished in a few years has upset the most optimistic forecasts. The first concerns the *Mondovision* broadcast which was made when man first landed on the moon and showing the two astronauts carrying out their delicate mission on lunar soil. Admittedly, technicians had already foreseen the practical use of television in the exploration of outer space. But the fact that pictures could be seen at the same time by several million viewers on all five continents, in their own homes, made this new telecommunication medium much more impressive than a mere instrument of space research.

The second example illustrates even more strikingly how events today have exceeded all expectations. I refer to telecommunications by satellite. You will remember that in 1963 we were still thinking of low-altitude and medium-altitude satellites which, because of their drift in relation to the earth, required extremely complex earth stations. At that time some doubt was felt about the utility of geostationary satellites in view of the long propagation delay involved.

Today, not quite eight years later, we are already accustomed to geostationary satellites providing high-reliability and high-capacity telecommunication services between countries which, without this new medium, could never have been linked up by high-quality service.

* * *

In order to arrive at a correct estimate of our responsibilities in space matters, I think that we must look beyond the technical reasons which led us to convene this Conference and focus our attention on the following basic questions:

|| Why was the ITU created and what is the justification for its existence?

To answer such questions, we must remember two things: the first is that the operation of a telecommunication service, however simple it may be, demands appropriate equipment, i.e. capital investment; the second is that the user of the equipment must enjoy satisfactory service quality and be sure that the equipment is highly reliable.

The corollary of these basic principles is that the telecommunication services must be protected at international level so that at no time do they become disorganized. It is likewise necessary that the costly equipment installed should at all times retain its original utility. This is true of telecommunications as a whole and particularly of radiocommunications.

Unfortunately, it appears that the international protection of telecommunication services is not always given the attention it deserves, though for the ITU such protection is a self-evident necessity. For it is practically impossible to conceive how any form of telecommunications could be organized in complete disregard of the international regulations established by the ITU.

Who could, or would want to, invest money in modern telecommunication equipment without the assurance that it would function satisfactorily? We can go even further and say without any hesitation that much of the work of research and development on which the advance of modern telecommunications is based, would be worthless without the regulations established by the ITU which protect both existing and potential services.

The ITU thus creates the conditions required for the effective use of telecommunication services in an international environment. To do so, it prepares regulations which govern equally the technical, opera-

tional and administrative aspects of telecommunications.

It is therefore your job to draw up appropriate regulations which can be applied to all the services which use space techniques now or may use them in the future.

In other words, this Conference must define the framework of regulations that will ensure the harmonious operation of all the services which resort, or will resort to, the use of satellites. Some of these services—telecommunications and meteorology, for example—are already working. Others, such as satellite broadcasting, surveying the natural resources of the earth and aids to the mobile services, will shortly be introduced. There is also radio astronomy, which will certainly be one of your main preoccupations.

Of course it is not an easy task to concretize the requirements of all users, both present and future, large and small, and to safeguard their legitimate interests. But we are convinced that, as in the past, the ITU will faithfully discharge its responsibilities in all these fields.

* * *

For space telecommunications in particular, the ITU's role is of fundamental importance since, once a spacecraft is launched, its only link with the earth is that provided by radiocommunications. In other words, without radio there could be no space activities, so that the motions of deep space and telecommunications are absolutely inseparable.

Aware of this fact, each of the Administrative Conferences held since 1959 has taken account in some way of the introduction of satellites. Thus the 1963 Conference established the first regulations on space radiocommunications; but now, eight years later with the constant advances of technique, we are again confronted with the same problems. We now have a much better idea of all the possibilities offered by space for such purposes as are in the mobile aeronautical and maritime services, satellite broadcasting and many other practical applications.

Today, satellite telecommunications have become an important part of international telecommunications and have reached the stage of commercial operation on an intergovernmental level. In this connection, I should like to refer in particular to the adoption, a few days ago, of the Definitive Agreement governing the international communication-satellite organization " INTELSAT ".

This new organization is the first intergovernmental commercial enterprise ever set on foot. We are therefore justified in asking whether INTELSAT does not owe its world-wide role above all to the truly international nature of telecommunications themselves, just as our Union did when it was set up 106 years ago. Personally, I am convinced that this is the case and we are looking forward with interest to the emergence of new possibilities for international co-operation resulting from the activities of the intergovernmental organizations responsible for the rational exploitation of these new media. Such an activity would be a natural extension of the ITU's technical and regulatory tasks.

editorial

Needless to say, the reinforcement of existing telecommunication services is not the sole purpose of satellite telecommunications. They offer a number of quite new possibilities, such as highly reliable links with a large circuit capacity and spanning great distances while using only comparatively small mobile earth stations.

It is to take advantage of this new possibility that some of the organizations in the United Nations family are seeking to employ the new media in emergencies such as the natural catastrophes which have recently devastated Peru and East Pakistan. For the destruction of means of communication in the disaster areas is one of the major obstacles to the launching of prompt and effective relief operations. These difficulties can, however, be rapidly overcome by the use of small mobile equipments and this naturally leads us to speak of the role that this Conference can play in ensuring the economic and social development of mankind, a role which was so well brought out by the Secretary-General of the United Nations in his message.

Speaking to the participants at the closing ceremony of the negotiations on the INTELSAT Agreement, President Nixon rightly referred to the "communication gap" which is certainly the main cause of the lack of comprehension between peoples. That gap, which must be filled, is one of the problems with which this Conference will have to deal, and I am sure that you will often have it in mind during your deliberations.

* * *

Mr. Chairman,

Distinguished delegates,

Your task is a very complex one; but it will be greatly facilitated by the excellent technical groundwork constituted by the numerous proposals submitted by the various administrations. It will also be facilitated by the Final Report prepared by the CCIR Special Joint Meeting which met in Geneva early this year. You thus have a solid foundation which will enable you to avoid the long discussions which invariably arise whenever an attempt is made to envisage the future on the basis of the techniques of the past.

* * *

In conclusion, I am surely not mistaken in asserting that the repercussions of this Conference in human terms will be very far-reaching. Some of the telecommunication services for which you are going to draw up regulations—and I am thinking more especially of direct satellite broadcasting and of satellites for surveying the earth's natural resources—will exert a decisive influence on the future of mankind. That is an unquestioned fact.

We are fortunately, from many points of view, well equipped to draw up appropriate regulations. The Members of the ITU possess a valuable body of experience in this matter and the impressive array of highly qualified experts who are gathered together here is the best guarantee of success in your work.

May I therefore wish you every success in the accomplishment of the difficult task before you.

union activities

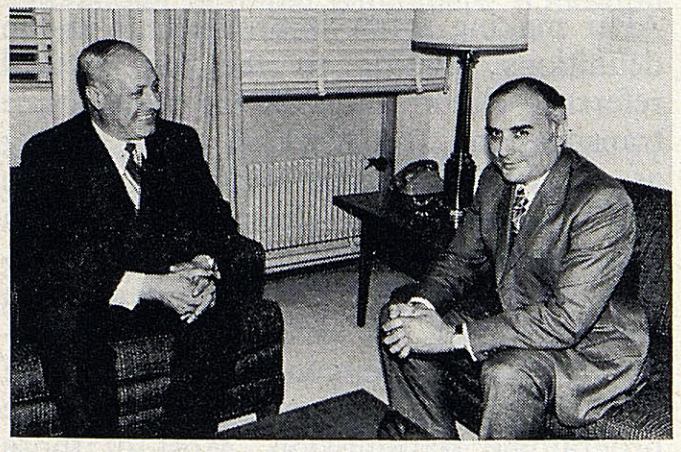
Visit by the Permanent Representative of Czechoslovakia

Mr. J. Knížka

Mr. Jaroslav Knížka, recently appointed Permanent Representative of the Czechoslovak Socialist Republic at the Office of the United Nations and the other international organizations in Geneva, visited ITU headquarters on 15 June 1971 where he had a talk with Mr. M. Mili, Secretary-General of the Union.

Visit by the Permanent Representative of Algeria

Mr. Raouf Boudjakdji, recently appointed Ambassador, Permanent Representative of the Algerian Democratic and Popular Republic at the Office of the United Nations and the other specialized agencies in Geneva, paid a visit to Mr. M. Mili, Secretary-General of the Union, on 16 June 1971.



M. Boudjakdji (right) during the visit he paid to the Secretary-General of the ITU

Meeting of CCITT Joint Working Party MAT

Mr. H. Biehler

Joint Working Party MAT (Automatic telegraph maintenance) of the CCITT, entrusted with the study of a question common to Study Groups IX and X (Questions 22/IX and 11/X), met in Geneva from 22-24 March 1971 under the chairmanship of Mr. H. Biehler (Federal Republic of Germany).

General

The III Plenary Assembly of the CCITT (Geneva, 1964) decided to submit for study the question of an automatic test technique of telegraph circuits. As Study Groups IX (Telegraph transmission) and X (Telegraph switching) were equally interested in this question. The General Assembly set up the Joint Working Party MAT for its study. Already in study period 1964-1968 the Joint Working Party MAT had made a draft recommendation which was accepted by the IV Plenary Assembly (Mar del Plata, 1968) as Recommendation R.79. The most difficult problem was to find a test procedure compatible with all national switching techniques. The meeting of Joint Working Party MAT from 22-24 March 1971 contributed especially to improving Recommendation R.79 in this respect.

Introduction of a " ready-for-test " signal

According to the present Recommendation R.79 the active station should initiate the transmission of the test signals (Q9S text), when the number of blocks received after reception of the call connected signal has been recognized as correct. These blocks are the answer-back code of the passive station and possibly the date/hour signals and the " who-are-you " signal. This may give rise to difficulties, in case circuits routed via ARQ systems are tested, because in this case, owing to cycling on the ARQ link, a block may be divided, producing in this way the false impression of two or more blocks. Therefore, the Working Party decided to discontinue the procedure of block counting and to introduce in its place a " ready-for-test " signal, which is transmitted as the last block by the passive station and after reception of which the active station can start transmitting the test signals.

The introduction of the " ready-for-test " signal also enables the passive station to recognize whether it is connected with an automatic testing station or erroneously connected with a subscriber. In the latter case, i.e. when no " ready-for-test " signal is received, the active station will release the connection.

For the " ready-for-test " signal four times combination No. 11 (K) was selected.

Answering the " who-are-you " signal

Because in some national networks it is absolutely necessary to transmit the " who-are-you " signal and to receive the identification code before the connection is established, the Working Party decided that the active station is bound in any case to transmit the identification code after reception of the " who-are-you " signal and that the passive station, after having transmitted the " who-are-you " signal, has to wait for reception of the identification code before it is allowed to transmit the " ready-for-test " signal.

Timing

In order to ensure perfect co-operation of automatic testing equipment, further time tolerances were agreed for the test procedure and specified in a timing diagram.

Programme of further activities of Joint Working Party MAT

Owing to the insufficient information available it was impossible to make

a final decision on the following items, which require further study.

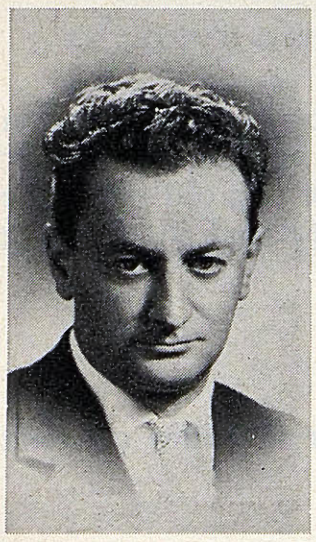
1. Above all, those administrations, whose international traffic is routed to a great extent via intercontinental circuits, want also those circuits to be included in the automatic test which are routed via time-division-multiplex telegraph systems or regenerative repeaters. There would not be much sense in using the two decision levels (10% and 14% isochronous distortion), which were agreed to be applied up to the moment, for testing these circuits. Additional decision levels and consequently additional access codes would be required. The number of access codes available in some countries is, however, very limited.

2. When Study Group IX will have finished studying Question 18/IX and new values of telegraph distortion are laid down in Recommendations R.50, R.57 and R.75, it will be the task of Joint Working Party MAT to make a corresponding adjustment of the automatic test procedure.

3. Some administrations want a simplified loop test method to be recommended. The possibilities to realize this procedure and its compatibility with the procedure according to Recommendation R.79 require further study.

H. B.

Meeting of CCITT TGX Working Party



Mr. G. Puccioni

CCITT TGX Working Party (Worldwide telex and gentex routing plan) held a meeting in Geneva from 25 to 31 March 1971 under the chairmanship of Mr. Gino Puccioni (Italcable).

The Working Party aims at introducing a fully automatic telex service between all the countries of the world, by the use of direct intercontinental links, or by the use of intercontinental transit circuits and exchanges.

The implementation requires the establishment of an automatic intercontinental telex network, consisting of intercontinental circuits connecting exchanges situated in different countries and different continents, intercontinental transit circuits used primarily for routing intercontinental transit traffic, and intercontinental transit exchanges.

Exchanges of this type would be directly connected to the intercontinental transit circuits and would provide facilities to interconnect intercontinental transit circuits and trunks to terminal exchanges.

Selection control of the intercontinental circuits of the automatic telex network will consist of digits only. A group of two or three digits—the telex destination code—will uniformly characterize each country or network for the purposes of selection in intercontinental transit circuits.

A plan for telex destination codes (Recommendation F.69) was set up by CCITT for identifying each country (or network) in a uniform manner for controlling the selection of intercontinental transit circuits.

An intercontinental signalling system to be used between intercontinental transit centres has been recommended by CCITT, as signalling system type C.

The TGX Working Party, in their March 1971 meeting in Geneva, reviewed the present status of the automatic world telex network.

The Party examined the answers given by different countries to the CCITT questionnaire concerning the present situation of the telex transit centres.

From the answers it appeared that transit centres exist at present in Frankfurt, London, New York, Nicosia, Rome and Tokyo. There exist also plans for a number of other countries.

The meeting considered that a compilation of a list showing projected dates for testing and entry into service of type C centres would be useful; it therefore decided to send the questionnaire out again, reduced to a few basic questions.

The Party introduced some amendments in the C-type signalling scheme, and considered the problems to be solved to establish the automatic intercontinental transit telex network.

G. P.

Meeting of CCITT Study Group XV

M. F. Job

Study Group XV (Transmission systemes) of the CCITT met in Geneva from 25 March to 2 April 1971 — its second meeting during the period 1968-1972 — under the chairmanship of Mr. F. Job (France).

It examined all the 44 questions in its programme and in particular heard reports on the work done by the Working Parties set up at its previous meeting, which had all met once or twice since then.

1. Programme circuits

The Working Party of Mr. Simpson (United Kingdom) was responsible for studying seven questions relating to programme circuits (Questions 1, 2, 4, 6, 7, 8 and 19/XV).

After making a few improvements in the definitions relating to the hypothetical reference circuit and link for programme transmissions, the Working Party, taking as a basis the wishes expressed by the CMTT (Joint Study Group on television transmission), studied the recommendations relating to the characteristics at audio frequencies of the whole of the hypothetical reference circuit or of sections of that circuit for high-quality monophonic programme transmission. Most of those characteristics were fixed but a few still require study. With regard to stereophonic

programme transmissions, a preliminary review was made of the characteristics considered desirable by the CMTT, which was asked to give additional information.

Three systems for high-quality carrier monophonic and stereophonic transmission were examined. In view of the acknowledged need for a single solution to facilitate international interconnection, preference was given, for international circuits, to the single sideband system described in Annex 5 to Question 7/XV (Volume *III* of the *White Book*), unless there was a special agreement between the countries involved. The Working Party made considerable progress with the preparation of recommendations on the characteristics of this system, but no agreement could be reached on the adoption of a single type of compandor.

2. Terminal and modulation equipments

With respect to the questions currently being studied for the completion of certain recommendations relating to 12-channel terminal equipment and modulation equipment, Study Group XV agreed as to the limit to be placed on the gain of channel equipment outside the band 300-3400 Hz (Question 3/XV), and on the maximum values to be recommended for carrier leaks in translating equipment * (Question 14/XV). These values, based on the possibilities open to manufacturers of such equipment, should be acceptable to the other Study Groups concerned. On the other hand, the Study Group, which had already decided on −36 dBr as the preferred value for the relative transmission levels at group and supergroup distribution frames (Question 22/XV) was unable to agree on a single value for the reception levels, so that administrations which have not yet fixed these levels will have to choose between the two figures −23 and −30 dBr. Similarly, two solutions were also decided upon for the levels of audio-frequencies at the input and output of 12-channel terminal equipment (Question 33/XV).

3. Crosstalk and interference in carrier systems

Study Group XV also reached agreement on the complex question of limiting the crosstalk between the two directions of transmission in the different parts of a carrier circuit (Question 9/XV). It defined the method for calculating the crosstalk on the circuit as a whole as a function of the values attributed to the elements in its make-up. The latter, reasonable from the manufacturing point of view, lead to crosstalk ratios on the whole circuit which in 100% of the cases do not reach the values recommended for programme circuits (Recommendation J.21) or those envisaged by Study Group XVI (Telephone circuits) for Recommendation G.232. Study Group XV nevertheless thought that they should be acceptable, especially since it should be possible to rearrange the routes in the very rare cases of a combination proving too unfavourable.

In the same spirit, Study Group XV set a limit of 74 dB for the intelligible crosstalk caused by intermodulation with the line pilot (Question 25/XV) on a homogeneous section of the hypothetical reference circuit.

Under the guidance of Mr. Pfyffer (Switzerland) considerable progress was made with the study of the difficult Question 37/XV, relating to the limitation on interference from industrial-frequency power supplies. The overall objective and the distribution of that objective between equipment and line on the hypothetical reference circuit were defined, as were the hypotheses and the methods of calculation to be used to ascertain the composition of the interference from various sources. On these bases the study of this question will be continued by correspondence.

4. Regulation and regulators (Questions 11, 15 and 26/XV)

A Working Party under Mr. Soulier (France) defined the overall objectives, the types of recommendation to be prepared and the working methods to be adopted for the continuation of the study.

5. Telephone compandors (Question 5/XV)

Recommendation G.162 was finally adopted as it stands.

6. Echo suppressors

The Working Party under the chairmanship of Mr. Helder (United States) finalized the text of Recommendation G.161 concerning echo suppressors. The Working Party will in future concentrate mainly on the study of new methods for protection against echoes.

7. Systems with a very large number of channels

The recommendations on the chief characteristics of the 60 MHz system on 2.6-9.5 mm coaxial pairs (Question 20/XV) were reviewed, with respect both to the cable (Working Party of Mr. Blanchi, France) and to the equipment. Certain special points requiring further study were defined.

Mr. Blanchi's Working Party also started to collect information on the characteristics of new coaxial pairs envisaged for the transmission of more than 2700 channels (Question 21/XV), and also on the characteristics of 2.6-9.5 mm coaxial pairs at more than 60 MHz.

Mr. White (United Kingdom) was elected Chairman of the Joint Working Party XV/Special D on waveguides. The Working Party exchanged information and prepared a working programme. It was generally agreed that at the present time the most appropriate guide diameter was 50 mm.

8. Submarine cable systems

An enquiry by correspondence is being conducted on the electrical and mechanical characteristics of submarine cables in current use in order to assess their interchangeability when repairs are needed.

9. Visual telephone service (Question 34/XV)

The Working Party under the Chairmanship of Mr. Köpping (Federal Republic of Germany) was concerned mainly with the " visual telephone service " but agreed that subsequently it would examine the possibility of transmitting other services in the same band.

A video-frequency band of about 1 MHz was decided upon. Agreement was reached on some of the characteristics of the picture: scanning (horizontal), interlacing (2/1), scanning frequency of the lines (8 kHz); no choice has yet been made between the approximate values of 50 or 60 for the number of frames per second.

* −43 dBmO for GROUP
−50 dBmO for SUPERGROUP
−45 dBmO for MASTERGROUP
−50 dBmO for SUPERMASTERGROUP or 15-SUPERGROUP (provisionally)

Study Group XV asked the Working Party to proceed forthwith with an examination of the other aspects of Question 34/XV: transmission standards to be recommended for international circuits (point *c)*), in collaboration with Special Study Group D (Pulse code modulation), and switching problems (point *d)*), to be defined before the competent CCITT Study Groups are approached.

10. Reliability (Questions 40 to 44/XV)

The Working Party chaired by Mr. Allan (Canada) finalized certain definitions and started an enquiry among administrations with a view to collecting information on the availability and reliability of the transmitting systems in operation.

11. LTG Working Party (Questions 35, 36, 38 and 39/XV)

Subject to the consent of the other Study Groups concerned, Study Group XV agreed to the proposals by Mr. Toutan's (France) Working Party concerning the limitation (to 3) of the number of types of telephone circuit, the unification of the recommendations relating to those circuits so that they can be used for purposes other than telephony and the unification of the characteristics of the signals transmitted. (In particular the line power would be fixed at −13 dBmO for data and frequency-modulation telegraphy and at −15 dBmO for new services). Considerable progress was also made with the revision of Recommendation H.14 relating to the characteristics of wideband group circuits.

12. Systems for the new and developing countries

Arrangements were made for Mr. Lawry (Australia) to complete the final draft of the handbook on overhead lines (Question 17/XV).

In the absence of sufficient information on the requirements of the countries concerned, no progress was made with Question 18/XV (cable systems with a small number of channels). The necessary information should be obtained in the replies to CCITT circular-letter No. 130, to which the attention of the administrations concerned was again drawn.

F. J.

Third World Telecommunication Day

Since 17 May 1971, ITU headquarters has been receiving a continuous flow of letters and telegrams describing how the third World Telecommunication Day was celebrated in different parts of the world. Information is still coming in so it is obviously impossible to present at this time a full picture of this year's celebrations.

The ITU distributed over 50 000 posters publicizing World Telecommunication Day and a selection of 38 photographs, depicting different types of telecommunications equipment and installations, was available to administrations and journalists on demand. Some 40 films were lent by the ITU Cinema Library to administrations for showing on 17 May.

Considerable press coverage of World Telecommunication Day was obtained as a result of press releases made by the ITU, by Member administrations and by United Nations Information Centres.

◄

The " ITU Trophy "

(Brazilian Administration)

Third World Telecommunication Day—Display of photographs supplied by the ITU at Communications Museum, Japan

(Ministry of P&T, Japan)

▼

Once again the Brazilian Administration organized a radio-amateur contest for the " ITU Trophy ". Last year the trophy was won by Surinam.

Special stamps to commemorate World Telecommunication Day were issued this year in 16 countries and many other countries used special cancellation marks. An article on the philately of World Telecommunication Day will appear in a forthcoming issue of the *Telecommunication Journal*.

The reports received show the excellent co-operation the ITU has had from Member administrations, from ITU experts and from the United Nations Information Centres in the organization of this year's World Telecommunication Day.

technical co-operation

The pan-African telecommunication project

With two meetings recently held in Cotonou (3-4 June 1971) and Monrovia (9-10 June), the work scope of the consultants who will shortly be engaged through the ITU was definitely determined.

• At the meeting in Cotonou, representatives of Dahomey, Ghana, Ivory Coast, Nigeria and Togo participated actively in determining the objectives of the consultants in performing their survey on the important link Lagos—Abidjan, interlinking all five mentioned counrties. The work of the consultants is expected to start in the beginning of November this year.

The Director-General of P&T, Ghana, Mr. E. M. Koram spoke on behalf of the delegates and expressed their thanks to the Dahomeyan Government for the arrangement of this meeting and the warm reception. He ended his speech by the following words " The day is not far distant when a telephone subscriber in one of the five countries may lift his received and call his friend in the other country. When the history of international subscriber dialling in this part of the world will one day be written, the Republic of Dahomey will be mentioned as the country which sponsered the first meeting of Nigeria, Dahomey, Togo, Ghana and Ivory Coast to usher this wonderful day ".

• The meeting in Monrovia considered the international links to be studied, connecting Guinea, the Ivory Coast, Liberia and Sierra Leone with each other as well as with the other countries of the world. The meeting was held at the Ministry of Planning under the chairmanship of Mr. S. Butler, Commissioner of Radio Communications.

The scope of work for the consultants was clearly defined by the delegates of the represented countries.

At the closing of the meeting Commisioner Butler expressed thanks to all members who attended the meeting and contributed to making it a sucess. He recalled that we all are aware of the many difficulties encountered in Africa, but that the development of communications within the continent is necessary economically, socially and politically for the progress of the continent as laid down in the Organization of African Unity (OAU) and which the ITU is interested in fostering.

Returns from mission...

... from Indonesia

M. Sten G. Sallander (Sweden) returned to Geneva for debriefing after a mission of two years and eight months as telecommunication lines and cables instructor at the Telecommunication Training Centre in Bandung, Indonesia. This mission was part of an ITU project under the United Nations Development Programme (UNDP)/Special Fund Component.

Departures on mission...

... to China

Mr. Gunther Seiz (Federal Republic of Germany) left for China towards the end of June 1971. He will be working as training adviser in telecommunications in Taipei. This mission is part of an ITU project under the United Nations Development Programme (UNDP) Technical Assistance Component.

... to Malawi

Mr. John W. Willmot (United Kingdom) left for Malawi at the beginning of May 1971. He will be working as project manager designate for the establishment of a multinational Posts and Telecommunication Training Institue in Malawi and national Training Institutes in Swaziland and Botswana. This mission is part of an ITU project under the UNDP/Special Fund Component.

... to Venezuela

Mr. Horst B. B. G. Kaufmann (Federal Republic of Germany) left for Venezuela in mid-June 1971. He will be working as instructor in outside plant at the Training Centre for Telecommunication Technicians in Caracas. This mission is part of an ITU project under the UNDP/Special Fund Component

... to Zambia

Mr. Torsten P. H. Olsson (Sweden) left for Zambia towards the end of June 1971. He will be working as a telephone switching instructor at the National Telecommunications and Postal Training Institute in N'dola. This mission is part of an ITU project under the UNDP/Special Fund Component.

conferences or meetings external to the I.T.U

International Conference on high-reliability electronic components

In connection with the Toulouse Electronic Days (JET — *Journées d'électronique de Toulouse*) the *Centre national d'études spatiales* (CNES) is organizing an international Conference on high-reliability electronic components to be held from 6 to 10 March 1972 at Toulouse.

During three sessions, original papers and discussions are expected both from physicists, research laboratory teams, makers and users, on the following subjects:

Physical reliability of components

— analysis of the processes of deterioration in time, characteristic functional parameters of the component
— methods of detecting deterioration.
— critical analysis of alternative methods of preventing or limiting deterioration.

Quality guarantees

— quality and manufacture
— standardization, specifications, dissemination of information.

New components and quality

This last session will deal with certain relatively new components which have not yet won their qualifications at high-reliability level, particularly MOS, microwave components, electron optics, certain thin-layer magnetic components, etc. In these papers, a general review will be made and an account given of the present state of development (and the problems connected with that development), emphasizing problems of quality and the means to be explored with a view to improving it.

Simultaneous interpretation will be provided from French into English and vice versa.

Registration fees are 500 French francs for participants and 300 fr. for speakers. In addition to admission to the Conference rooms, this fee covers the supply of the full text of papers delivered by speakers and lunches served in the Conference restaurant.

Proposals for papers should be transmitted not later than 15 October 1971 to: " Centre national d'études spatiales, Division des relations universitaires, 129, rue de l'Université, Paris VII ". — *CNES.*

Symposium on computer-communications networks and teletraffic

The 22nd in the series of annual international symposia organized by the Polytechnic Institute of Brooklyn (PIB) will be on the topic of computer-communications networks and teletraffic. The symposium will be held from 4 to 6 April 1972 in New York.

One of the primary objectives of the symposium is to attempt to place in perspective the fundamental theories associated with the study of computer-communications networks and teletraffic. Also, applications of these theories to the analysis and design of message-switching networks, store and forward systems, communication nets and traffic models will be among the main themes of the symposium. While there are many interesting related problems ranging from the purely mathematical to public policy questions, the symposium will emphasize two categories of papers: the first one contributes basic and broadly applicable tools for the analysis and/or synthesis of computer-communication networks; the second includes those papers which are concerned with specific problems associated with the design and operation of such networks. The specific topics planned for inclusion in this symposium are:

— theory of connecting networks—combinatorics, topology, flow analysis, optimization
— queuing theory in communication networks—buffered networks, networks of queues
— telecommunication switching—theory and applications
— telecommunications aspects of time-sharing computer systems
— modeling and simulation
— architecture of computer-communications systems
— software problems—real time operating systems, routing and scheduling, optimum resource allocation
— error detection, correction and diagnostics
— applications—experimental systems and novel approaches.

Papers dealing with other topics relating to the theme of the symposium will also be presented.

For further information write to the following address: " Polytechnic Institute of Brooklyn, MRI Symposium Committee, 333 Jay Street, Brooklyn, NY 11201" .—*PIB.*

International Symposium on electronics and civil aviation

An international Symposium on electronics and civil aviation will be held in Paris during the second half of June 1972.

The symposium is organized by the Union of International Engineering Organizations (UIEO) and the *Société française des électroniciens et des radioélectriciens* (SFER), and is under the patronage of the *Fédération nationale des industries électroniques* (FNIE) and the *Service technique de la navigation aérienne* (STNA).

The purpose of the symposium is to examine the electronic equipment systems that may be of use to civil aviation and the new developments envisaged for each of those systems, and to consider the numerous technical and operating problems involved in their use. Various interests will be represented at the symposium: administrations, airlines, aircraft builders and electronic equipment manufacturers.

The papers read at the symposium will be on one of the following subjects:

— telecommunications
— navigation
— landing
— radar and air traffic control
— piloting
— reliability — safety.

For further information, write to the following address: " Secrétariat du Colloque international, 16, rue de Presles, Paris XV ".

NASA's Manned Space Flight Network

TRACKING, command and communication—*Apollo's* vital links with the earth—are performed in two broad phases.

For the first phase, the National Aeronautics and Space Administration (NASA) Manned Space Flight Network (MSFN) depends largely on its world-wide chain of stations equipped with 9 m antennae while Apollo is launched and orbiting near the earth. The second phase begins when the spacecraft moves out more than 16 000 km above earth, when the 26 m diameter antennae bring their greater power and precision into play.

The MSFN must furnish reliable, instantaneous contact with the astronauts, their launch vehicle and spacecraft, from lift-off through earth orbit, moon landing and lunar take-off to splash-down in the Pacific Ocean. It consists of 12 ground stations, one ship, and four jet aircraft—all directly or indirectly linked with Mission Control Center (MCC) in Houston. While the earth turns on its axis, and the moon travels in orbit nearly 400 000 km away and the Apollo spacecraft moves between them, ground controllers will be kept in the closest possible contact. Thus, only for some 45 minutes as the spacecraft flies behind the moon in each orbit, is this link with earth broken.

All elements of the network get ready early in the count-down. As the Apollo is launched from Cape Kennedy, voice and data are transmitted instantaneously to Houston. The data are sent directly through computers for visual display to flight controllers.

Depending on the launch azimuth, the 9 m antennae keep tabs on Apollo, beginning with the station at Merritt Island (Florida), thence Bermuda, the tracking ship *Vanguard*, the Canary Islands, Tananarive (Madagascar), Carnarvon (Australia), Guam, Hawaii and Corpus Christi (Texas).

To inject Apollo into translunar flight path, Mission Control sends a signal through one of the land stations. As the spacecraft heads for the moon, the engine burn is monitored by the ground stations and an Apollo range instrumentation aircraft (*ARIA*). The ARIA provides a relay for the astronauts' voices and data communication with Houston.

When the spacecraft reaches an altitude of 16 000 km the more powerful 26 m antennae join in for primary support of the flight, although the 9 m " dishes " continue to track and record data. The 26 m antennae are located about 120° apart at Madrid (Spain), Goldstone (California), and Canberra (Australia).

With the 120° spacing around the earth, at least one of the large antennae always has the moon " in view ". As the earth revolves from west to east, one 26 m station hands over control to the next 26 m station as it moves into view of the spacecraft. In this way data and communication flow is continuous.

Data are always relayed back through the large antennae and transmitted via the NASA Communications Network (NASCOM)—a 3 200 000 km hook-up of landlines, undersea cables, radio circuits and communication satellites—to Houston. This information is fed into computers for visual display in Mission Control—for example, a display of the precise position of the spacecraft on a large map. Or, returning data may indicate a drop in power or some other difficulty in a spacecraft system, which would energize a red light to alert a flight controller to action.

Returning data flowing through the earth stations give the necessary information for commanding mid-course manoeuvres to keep Apollo in a proper trajectory for orbiting the moon. While Apollo is in the vicinity of the moon, these data indicate the amount of retro burn necessary for the service module engine to place the spacecraft in lunar orbit.

Once the lunar module separates from the command module and goes into a separate lunar orbit, the MSFN is required to keep track of both spacecraft at once, and provide two-way communication and telemetry between them and the earth. The prime antenna at each of the three 26 m tracking stations handles one spacecraft while a wing, or back-up, antenna at the same site handles the other spacecraft during each pass.

Tracking and acquisition of data between earth and the two spacecraft provide support for the rendez-vous and docking manoeuvres. The information is also used to determine the correct time for putting the service module into a precise trajectory for re-entering the earth's atmosphere at the planned location.

As the spacecraft comes toward earth at high speed—more than 40 000 km per hour—it must re-enter at the proper angle. To make an accurate re-entry, information from the tracking aircraft and stations is fed into the MCC computers where flight controllers make decisions that will provide the Apollo crew with the necessary information.

Appropriate network stations and aircraft in the Pacific are on hand to provide support during re-entry. An ARIA aircraft relays astronaut voice communications to MCC, and antennae on re-entry ships follow the spacecraft.

Throughout the journey to the moon and back, television signals are received from the spacecraft at the Goldstone, Madrid, and Canberra 26 m antennae. In addition, 61 m diameter antennae in California and Australia are used to augment the television coverage while the Apollo is near and on the moon. Scan converters at the stations permit immediate transmission of commercial quality television via NASCOM to Houston, where it is then released to television networks.

The NASA Communications Network (NASCOM)

The NASA Communications Network consists of several systems of diversely routed communications channels leased on communications satellites, common carrier systems and high frequency radio facilities where necessary to provide the access links.

The system includes both narrow and wide-band channels, and some television channels. Among these are a variety of telegraph, voice, and data systems (digital and analogue) with several digital data rates. Alternate routes or redundancy provide added reliability.

A primary switching center and intermediate switching and control points provide centralized facility and technical control, and switching operations under direct NASA control. The primary switching center is at the Goddard Space Flight Center (GSFC), Greenbelt, Maryland. Intermediate centers are located at Canberra, Madrid, London, Honolulu, Guam, and Kennedy Space Center.

The Kennedy Space Center is connected directly to the MCC, Houston, via the Apollo Launch Data System and to the Marshall Space Flight Center, Huntsville, Alabama, by a Launch Information Exchange Facility.

After launch, all network tracking and telemetry data is directed to GSFC for transmission to MCC Houston via two 50 000 bits/s circuits used for redundancy and in case of data overflow.

Two *Intelsat* communications satellites are used for Apollo. The Atlantic satellite services the Ascension Island unified S-band (USB) station, the Atlantic Ocean ship and the Canary Islands site. The second Apollo Intelsat communications satellite over the mid-Pacific services the Carnarvon USB site. These stations transmit simultaneously through the satellite to Houston via Brewster Flats (Washington State) and the Goddard Space Flight Center.

Network computers

At fraction-of-a-second intervals, the network's digital data processing systems, with NASA's Manned Spacecraft Center as the focal point, communicate with each other or with the spacecraft. High-speed computers at the remote site (tracking ships included) issue commands or " up-link " data on such matters as control of cabin pressure, orbital guidance commands, or " go no-go " indications to perform certain functions.

When information originates from Houston, the computers refer to their pre-programmed information for validity before transmitting the required data to the spacecraft.

Such " up-link " information is communications by ultra-high-frequency radio at about 1200 bits/s. Communication between remote ground sites, via high-speed communications links, occurs at about the same rate. Houston reads information from these ground sites at 2400 bits/s, as well as from remote sites at 100 words/min.

The computer systems perform many other functions, such as:

—ensuring the quality of the transmission lines by continually testing data paths;

—verifying accuracy of the messages by repetitive operations;

—constantly up-dating the flight status.

For " down-link " data, sensors built into the spacecraft continually sample cabin temperature, pressure, physical information on the astronauts such as heartbeat and respiration, among other items. These data are transmitted to the ground stations at 51.2 kbits/s.

At MCC the computers:

—detect and select changes or deviations, compare with their stored programmes, and indicate the problem areas or pertinent data to the flight controllers;

—provide displays to mission personnel;

—assemble output data in proper formats;

—log data on magnetic tape for replay for the flight controllers;

—keep time.

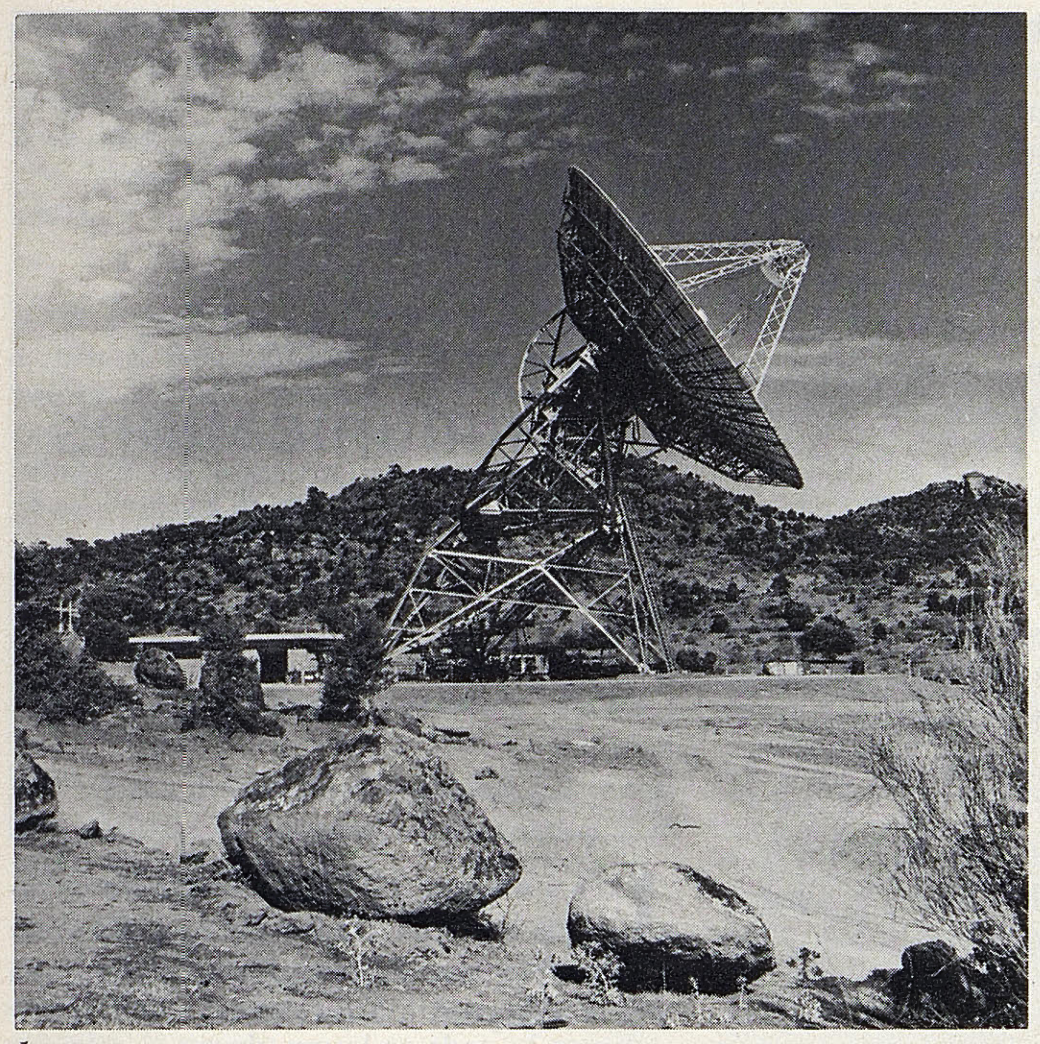
The Apollo ship and aircraft

The mission is supported by one instrumentation ship operating as an integral station of the MSFN to provide coverage in areas beyond the range of land stations, and four instrumented jet aircraft on station over the South Pacific.

The ship, USNS Vanguard, performs tracking, telemetry, and communication functions for the launch phase, and earth-orbit insertion.

It is stationed about 1600 km south-east of Bermuda (25° N, 49° W) to bridge the Bermuda—Ascension Island gap during earth—orbit insertion. Vanguard also functions as part of the Atlantic recovery fleet in the event of a launch phase contingency. In the event of the launch date being delayed, the ship normally moves in a north-eastward direction to cover the changing translunar injection location.

The Apollo ship was developed jointly by NASA and the United States Department of Defense (DOD). The DOD operates the ship in support of Apollo and other NASA and DOD missions on a non-interference basis with Apollo requirements.



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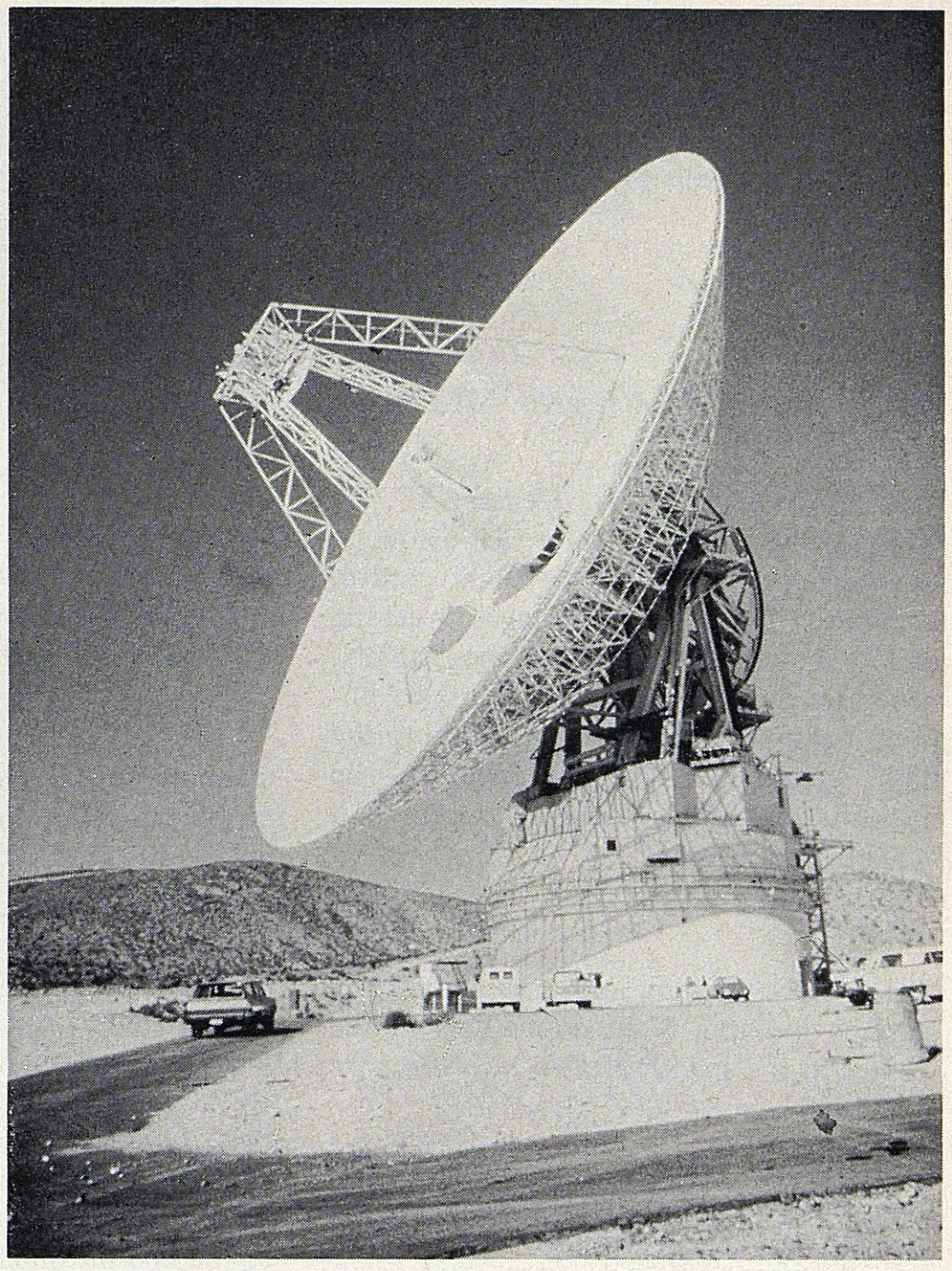
Deep space network station at Robledo de Chavela Madrid, (Spain)

(NASA)



2

2

The 64 m diameter antenna of the Goldstone (California) earth station

(ITU)

The technical crews operate in accordance with joint NASA-DOD standards and specifications which are compatible with MSFN operational procedures.

The ARIA aircraft are used primarily to fill coverage gaps between Australia and Hawaii during the translunar injection interval. Prior to and during the burn, the ARIA record telemetry data from Apollo and provide real-time voice communication between the astronauts and MCC, Houston.

Four aircraft participate, operating from Pacific, Australian, and Indian Ocean air fields in positions under the orbital track of the spacecraft and launch vehicle. The aircraft are deployed in a north-westward direction in the event of launch day delays.

For re-entry, two ARIA are used in the landing area region to continue communications between Apollo and MCC, Houston and provide position information on the, spacecraft after the blackout phase of re-entry has passed.

The total ARIA fleet for Apollo missions consists of four *EC-135A (Boeing 707)* jets equipped specifically to meet mission needs. They carry 2.15 m parabolic antennae in the nose section, giving them a large, bulbous look.

The aircraft, as well as flight and instrumentation crews, provided by the Air Force, are equipped through joint Air Force-NASA contract action to operate in accordance with MSFN procedures.

The Mission Control Center (MCC)

The Mission Control Center at the Manned Spacecraft Center, Houston, is the focal point for Apollo flight control activities. The Center receives tracking and telemetry data from the MSFN, processes data through its real-time computer complex and displays the data to the flight controllers and engineers in the mission operations control room and staff support rooms.

The MSFN tracking and data acquisition stations link the flight controllers at the Center to the spacecraft.

For Apollo all network stations are remote sites, that is, without flight control teams. All up-link commands and voice communications originate from Houston, and telemetry data are sent back to Houston at high-speed rates (2400 bits/s), on two separate data lines. They can be either real-time or playback information.

Signal flow for voice circuits between Houston and the remote sites is via commercial carrier, usually satellite, wherever possible using leased lines which are part of the NASCOM.

Commands are sent from Houston to NASA's GSFC on lines which link computers at the two points. GSFC communication computers provide automatic switching facilities and speed buffering for the command data. Data are transferred from GSFC to remote sites on high-speed (2400 bits/s) lines. Command messages can also be sent by teletype from Houston to the remote sites at 100 words/min. Again, GSFC computers provide storage and switching functions.

Telemetry data at the remote site are received by the RF receivers, processed by the pulse code modulation ground stations, and transferred to the *642B* remote-site telemetry computer for storage. Depending on the format selected by the telemetry controller at Houston, the 642B sends the desired format through a *2010* data transmission unit which provides parallel to serial conversion, and drives a 2400 bits/s modem.

The data modem converts the digital serial data to phase-shifted keyed tones which are fed to the high-speed data lines of the communications network.

Tracking data are sent from the sites in a low-speed (100 words) teletype format and a 240-bit block high-speed (2400 bits) format.

All high-speed data, whether tracking or telemetry, which originate at a remote site are sent to GSFC on high-speed lines. Goddard reformats the data when necessary and sends them to Houston in 600-bit blocks at a 40 800 bits/s rate. Of the 600-bit block, 480 bits are reserved for data, the other 120 bits for address, sync, intercomputer instructions, and polynominal error encoding.

All wide-band 40 800 bits/s data originating at Houston are converted to high speed (2400 bits/s) data at GSFC before being transferred to the designated remote site.—*NASA.*

Telecommunications in Japan

JAPAN's domestic public telecommunications services are furnished exclusively by the Nippon Telegraph and Telephone Public Corporation (NTT).

Soon after the establishment of NTT in 1952, a long-term expansion programme was scheduled in order to improve the public telecommunications services. A series of three 5-year programmes had been carried out by 1967. During these 15 years, 8 300 000 subscriber lines were constructed and automatization of the telephone exchange was greatly advanced.

The fourth 5-year programme started from fiscal year 1968. The programme extends to fiscal year 1972 and aims at the construction of 9 300 000 telephone subscriber lines, 150 000 public telephones, about 400 000 channels of toll telephone lines, and 2000 telephone offices, increasing the variety of private data services, and inauguration of a public data service.

However, the quality demanded by the subscriber has changed as a result of recent economic growth and improvement of the living standard.

It has become important to provide more convenient telephone services, data communication and video communication, in addition to increasing the number of conventional telephones.

The fourth 5-year programme is being amended in line with recent circumstances.

The amended programme, covering the expansion of the last two years of the fourth 5-year programme, will be merged into the fifth 5-year programme, making up the 7-year programme planned in August 1970.

This programme plans to offer various kinds of new services such as the videophone service, private and public data communication services and so on, in addition to constructing 19 700 000 telephone subscriber lines.

Automatic telephone exchange systems

NTT has adopted various kinds of crossbar switching systems and introduced them widely since 1952.

As a result, the total quantity of crossbar equipment being used throughout the country is nearly equal to that of step-by-step equipment, and the proportion of crossbar equipment will rise rapidly from now on.

There are three different categories of crossbar switching systems in Japan.

• One is a standard system for local exchanges. The *C400* and *C460* are of this category. The C400 has an initial economic capacity of about 5000 lines and a practical ultimate capacity of about 60 000 lines in its standard design, and the C460 has about 700 initial lines and 11 000 ultimate lines.

The C400 and the C460 have been designed with a view to providing many new telephone services, such as push-button dialling, call-waiting, etc. which will be demanded by subscribers. Push-button dialling and abbreviated dialling are in practical use through the C400 switching system. Call-waiting equipment has also been developed and was placed in commercial use last autumn.

• The second category, the transportable automatic exchange unit, is for small local exchanges in rural areas. The *C11* and *C23* come under this heading. The C11 and C23 are installed in a special steel cabinet together with the power equipment and main distribution frame (MDF). They are small enough for easy transportation, and are used for unattended offices.

• The third category is for toll transit exchanges. The *C82*, which is designed for 4-wire switching of long-distance calls, belongs to this category. To provide good transmission performance, the C82 is used not only at a regional centre or district centre, but also at many toll centres.

Until commencement of full-scale introduction of electronic switching systems, the standard type of crossbar switching system in Japan will be C11, C23, C460 and C400 for local service, and C82 for toll service.

A research project on the use of solid-state electronic devices for switching systems was started in 1954 by the NTT laboratory. Since then, four prototypes on different principles were designed and tested, although all were of wired-logic type. One of the prototypes was in practical service for about seven years. However, as research and development on stored-programme computers progressed, it has become clear that stored-programme electronic switching systems will be more advantageous than other switching systems.

In these circumstances, a large-scale project for developing stored-programme electronic switching systems was established in 1964. The first prototype of this kind, called *DEX-1*, was installed in the NTT laboratory in early 1966. Since then, studies on stored-programme techniques have been conducted, using the DEX-1 in the laboratory as a private automatic branch exchange (PABX).

DEX-1 is a space division switching system with mechanical speech paths (Fereed switch) controlled by an electronic central processor composed of discrete components. On the other hand, the time division multiplex-pulse code modulation (TDM-PCM) technique has also been studied. A prototype of the TDM-PCM 4-wire switching system called *DEX-T-1* was installed in early 1967.

Based on the experience gained with DEX-1, the second large-scale prototype *DEX-2* was designed in 1967. A field trial of DEX-2 was started in December 1969 in the Ushigome office, and now 3000 customers are served through DEX-2.

The main difference between DEX-1 and DEX-2 is in their components. Miniaturized crossbar switches are used in the speech path of DEX-2 instead of Fereed switches, and integrated circuits are widely used in the common control part of DEX-2 instead of discrete components.

As a result of the economic evaluation made from the DEX-2, substantial improvements were made in regard to the design of components, resulting in *DEX-21* in 1968. This system combines local and toll switching functions, and will be the final prototype of the electronic switching system for central offices. A large-scale introduction of electronic switching is scheduled to commence in seven offices in 1972 and will be expanded to more than 400 by 1977.

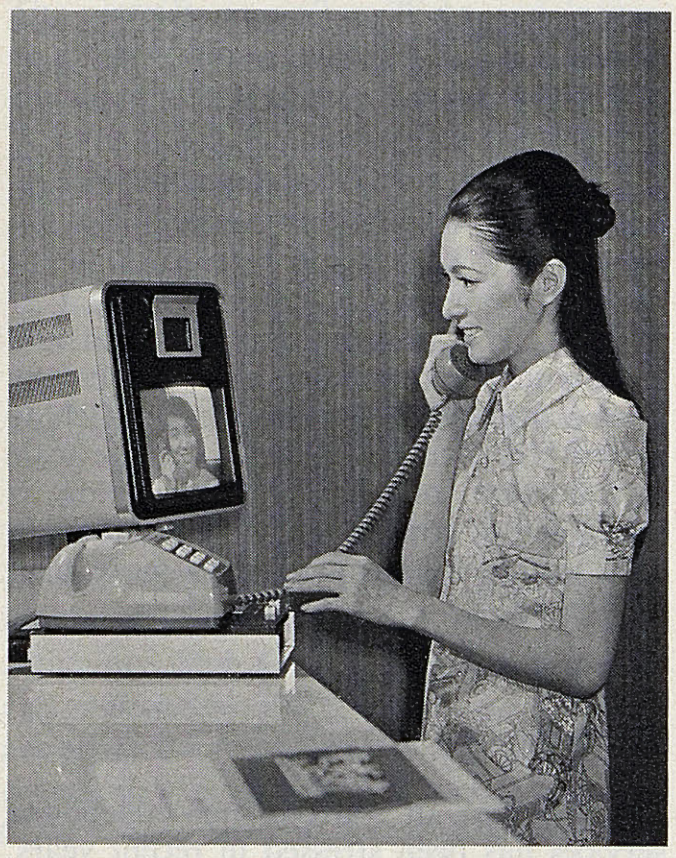
Telephone sets

Development of various new telephone services has been stressed in recent years. As a result, push-button telephones (with 12 buttons), variable abbreviated dialling, call-waiting, and centralized extension system (*centrex*) having a variety of basic and optional functions, have been put into use. Many more new services, as for instance, call-forwarding, add-on, message recording for absentees, etc., will come into use in the near future.

In order to offer clear conversation to high-loss subscriber lines, a special telephone set was adopted. This telephone is provided with a highly sensitive transmitter and receiver, and with a new anti-sidetone circuit.

(NTT)

One of the 80 000 public telephones in Tokyo for local and trunk calls



(NTT)

525-line videophone operating on 4 MHz

Outside plant

Development of plastic covered cables and wires using polyethylene or polyvinyl chloride (PVC) for conductor insulation and sheathing started about 15 years ago. In recent years, almost all kinds of cable and wire use plastic materials for insulation.

Paper insulated Stalpeth cable and 0.32 mm PEF cable made by the foamed polyethylene coating process, a unique method in Japan, are used for large-size local cables. For small-size exchange cables, colour coded polyethylene insulated, polyethylene sheathed cable (CCP cable) has been brought into commercial use. During 1969, approximately 77 700 km of plastic-covered local cables were installed out of a total of 78 200 km of local cable installation.

Laminated aluminium-polyethylene sheathed CCP cable where a thin aluminium tape is bonded to the inner surface of the plastic sheath to reduce moisture permeation and giving it better mechanical characteristics, and jelly-filled waterproof CCP cable are now being tested for commercial use with a view toward higher cable stability.

A total length of approximately 7000 km of standard coaxial cable and 930 km of small-size coaxial cable have been laid to make up the main trunk networks throughout the country. The 4.4 mm small-size coaxial cable was developed in 1964 in Japan.

The toll foamed polyethylene insulated cable (toll PEF cable) has been developed for 12-channel short-haul carrier systems and approximately 40 700 km of this cable have been laid.

For the first time in Japan, plastic insulated cable was laid for submarine use in 1951. The repeatered submarine coaxial cable was laid in 1969, and buried with a newly developed burying machine for submarine cable which replaces the former water jet system machine.

In the underground telephone facilities department, precast polyester resin concrete man-holes were brought into commercial use in 1969. They feature reduced weight, simplified installation work, less excavating and require less repairs to road surface areas.

Hitherto, steel or cast iron conduits were used for underground cables, but, since the recent practical use of PVC conduits, great advantages have been brought about through reduction of initial construction cost and simplification of construction work.

Since the use of plastic-covered cables and the improvement of gas filling techniques, the frequency of cable failures which affect service has been greatly reduced.

At present, for gas filled systems, the continuous flow system with air dried by refrigerating method is used for local and trunk cables, and the periodic filling system is employed for coaxial and toll cables.

Cable transmission systems

In Japan, two types of coaxial cables have been employed, i.e. 2.6/9.5 mm standard type and 1.2/4.4 mm small diameter type mentioned above. Formerly, 4 MHz 960-channel systems had been applied on both types of cable, until a 12 MHz 2700-channel system for standard coaxial pairs was developed in 1962. Then, a fully transistorized 12 MHz 2700-channel system, applicable to both cables, was developed in 1967. Since then, this system has been used as the standard coaxial cable carrier system.

Taking account of the ever-increasing demand for toll traffic, including video and wide-band data transmission, intensive research has been conducted on further utilization of the frequency band of standard coaxial pairs.

A field trial of the 60 MHz 10 800-channel system was commenced last June with a prototype. This system is designed to provide 10 800 telephone channels in the form of 12 supermastergroups, and two adjacent supermastergroups can be replaced by one 4 MHz television channel (maximum six 4 MHz television channels or thirty-six 1 MHz videophone channels in a system).

As for submarine coaxial carrier systems, a final prototype of the transistorized 900-channel single cable system for shallow water was completed last year, and was laid and buried across Uchiura Bay, Hokkaido.

In addition, a 2700-channel single cable system for shallow water is scheduled to be put into use this spring. Research is also progressing on a 2700-channel single cable repeatered line for deep water.

Frequency division multiplex (FDM) was the only multiplexing method in practical transmission systems, until the 24-channel PCM system was developed in 1964. This system, applicable to toll cables and local exchange cables, is now widely used for toll trunks shorter than 100 km. Following this, the 120-channel PCM system was put into use in 1969. The regenerative repeatered line of this system transmits approximately 7.9 Mbits/s on a symmetrical pair of a conventional toll cable.

Development of this system is deemed an interim stage in the exploitation of PCM systems of higher speed compatibility between TDM-PCM and FDM-AM systems.

As for video transmission, high quality coaxial cable video transmission systems have been in use for leased-wire service for television broadcasting firms for the past ten years. Recently, 1 MHz and 4 MHz video transmission systems over conventional pair cables have been developed to meet the demand for the so-called "industrial television service". These systems can also be used for short-distance circuits of the video-telephone service expected in the near future.

Trial video-telephone service was offered at the site of EXPO'70 in Osaka, using the 1 MHz system with a crossbar exchange (see the *Telecommunication Journal* of July 1971, pp. 519-528). The video-telephone system is also in experimental use at the NTT Head Office.

All cable transmission equipments currently used as standard have been fully transistorized and miniaturized.

Recently, integrated circuits have also been introduced in several kinds of equipment. It is deemed that, from the practical viewpoint, adequate miniaturization of transmission equipment has already been attained. For instance, a 2.75 m standard carrier rack can accommodate 240 channels of channel translating equipment, five systems of PCM 24 terminals, or 360 units of negative impedance converters.

Radio transmission systems

Approximately half of the toll telephone trunks in Japan are carried by 2, 4, 6, 11 and 15 GHz microwave systems.

In addition, television transmission is another important role played by microwave systems. Television channels, carried mainly by 4 GHz systems, are leased to national and commercial television broadcasting firms operating about 1500 transmitter stations throughout the country.

The 4 GHz system provides 960 telephone channels or one *NTSC* colour television channel, while the 6 GHz system carries 1800 telephone channels.

A 4 GHz route accommodates six working systems and one standby system, while a 6 GHz route accommodates seven working systems and one standby. Both systems have been designed and used for long-distance heavy-traffic routes.

In order to improve the reliability and economy of these systems, the use of solid-state electronic devices has increased during the past several years. The latest model of the 6 GHz system is solid-state, except for one travelling wave tube for each system. A fully solid-state 4 GHz system was put into use in 1969. Apart from these, a 2700-channel 6 GHz system was developed last year and proved satisfactory in a field test.

Microwave systems in the 2, 11 and 15 GHz bands have been designed to carry relatively short-distance trunks.

There are two kinds of systems in the 2 GHz band. One is the 600-channel system designed for connecting isolated places or islands in rather long hops. The other is a rather special system which carries two groups of 120-channel PCM signals by four-phase phase-shift-keying modulation. Both systems are fully solid-state and are designed for simplified maintenance and installation.

The most popular microwave system for short trunks is the 960-channel 11 GHz system. Recently, a 960-channel 15 GHz system has been developed for solving congestion in the 11 GHz band.

In the field of mobile communication service, a new personal paging service through direct dialling, called *Pocket Bell*, was inaugurated in the Tokyo area in 1968, and is also available in the Osaka and Nagoya areas.

Due to its versatility, the demand far exceeded NTT's estimates. The service is planned to be extended to other major cities within a couple of years. A wireless telephone set with a push-button dial has also been developed. A trial use of this was conducted at the site of EXPO'70 in Osaka.

Research on guided millimetre-wave transmission has continued for more than ten years in the NTT laboratory.

Recently, a series of field tests were carried out over an experimental route comprising two 4 km spans of underground circular waveguides. Alternate connection of helix waveguides and dielectric-lined waveguides used for the experimental route has shown satisfactory characteristics, suppressing unwanted mode conversion. In the last year, a 225.4 Mbits/s 60 GHz pulse transmission test was made on this route, with fully solid-state repeaters using gallium arsenide diodes. The test proved satisfactory. A test on 800 Mbits/s four-phase phase-shift-keying transmission is being carried out this year, using another kind of repeater.

Fundamental research and field experiments on laser transmission systems have also been conducted by the laboratory. Devices now under research include a solid (YAG) laser oscillator, a high-speed optical modulator, and a confocal beam transmission through optical lenses, and so forth.

Data communication systems

1) Private data communication systems

Systems referred to as " private " are those which are designed, installed and maintained by NTT at the user's request but operated by the user.

The first of this category was the " data communication system for nation-wide banking business ", which was put into service in 1968. The central equipment of the system, located in a telephone building in downtown Tokyo, processes some 60 000 money orders a day. The Centre is connected via 200 bits/s circuits to 62 head offices of regional banks having 4100 branch offices scattered all over the country. This system is confined, for the present, to the 62 regional banks. However, a plan is also being made to develop a large system for the National Association of City Banks (comprising 13 large banks) and to integrate these two systems.

A " national car registration system " started partial operation in March 1970. A newly developed mark-sensing sheet reader is used in this system at 65 Land Transport Offices throughout the country.

Also, the " EXPO'70 Data Communication System " was supplied for the administrative business of EXPO'70 in Osaka, with a variety of data terminals, including cathode-ray tube (CRT) displays.

In addition, several systems such as banking, sales and inventory management, are being designed and installed by NTT in compliance with requests from various enterprises and governmental agencies.

2) Public data communication systems

NTT plans to inaugurate " public data communication systems ", which enable joint use of large computer systems by a number of subscribers through the public telephone network.

These systems are designed, installed, operated and maintained by NTT.

3) Data transmission

Data transmission circuits are in service at data signalling rates of up to 50, 200, 1200 and 2400 bits/s. The first three employ frequency modulation and the last-named employs four-phase shift modulation.

To meet high-speed data transmission requirements, NTT is adopting 48 kbits/s data transmission equipment using a wide frequency band transmission circuit. Field tests were completed in July 1970, and results were excellent in all aspects.

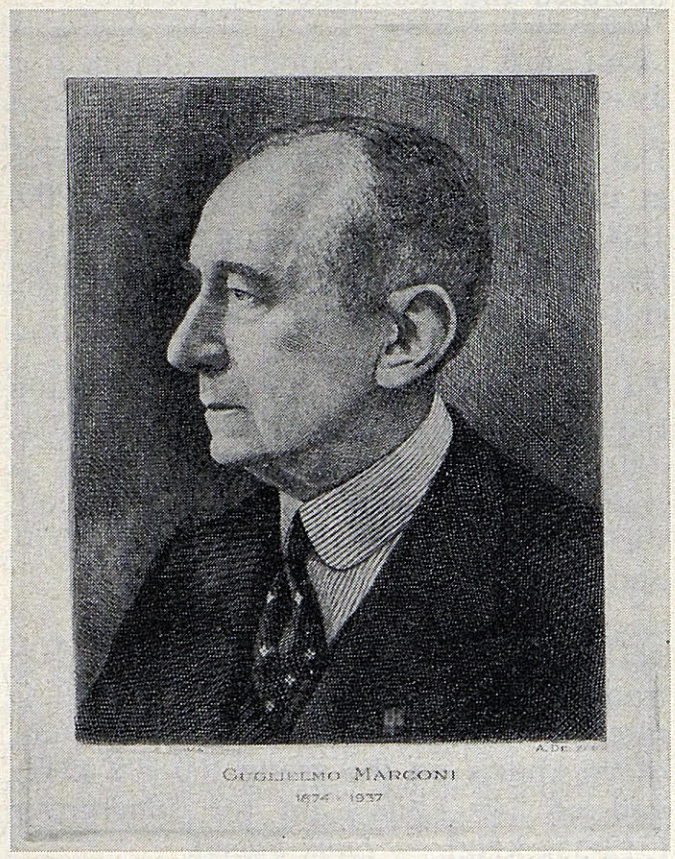
NTT is also researching high-speed data transmission services at data signalling rates of 4800 bits/s on the voice channel, of 96 kbits/s on the group (60-108 kHz), and of 240 kbits/s on the supergroup (312-552 kHz). — *Look Japan.*

Guglielmo Marconi

SEVENTY-FIVE years ago, on 2 June 1896, a patent application, No. 12039, was lodged with the British Patents Office. No single patent, before or since, has had such a profound effect upon the human race. Its specification concerned " Improvements in Transmitting Electrical Impulses and Signals, and in Apparatus Therefor "; it was the world's first for a system of radio communication. The applicant was an Italian subject, Guglielmo Marconi.

Marconi was born on 25 April 1874, the second son of Giuseppe Marconi, a well-to-do Italian landowner. His mother was Irish, one of the Jamesons, the whiskey distillers. At the age of five Guglielmo was brought to England to attend a private school at Bedford and remained there for two years. On his return to Italy he went to school in Florence, later transferring to Livorno where he studied physics under Professor Rosa.

A turning point in his life came in his teens when he attended lectures given by Professor Righi, a distinguished Italian scientist who had made an intensive study of the invisible electromagnetic waves discovered by Hertz in 1888 and had made valuable contributions to the state of the art as it then existed. Marconi studied Righi's writings and any other papers on Hertzian waves he could lay hands upon. It soon dawned upon him that these oscillations might be harnessed for communications applications; indeed, the concept was so obvious that at first he feared that the eminent scientists of the day must have already tried it and found it wanting. There was only one way to find out and that was to experiment for himself. Accordingly he set to work, building his apparatus and installing it in an otherwise disused top floor room at the Villa Grifone, the family's country residence near Bologna.



The equipment he built was a counterpart of apparatus then in common use in laboratories where the generation and detection of Hertzian waves were being studied. The transmitter was a battery-powered induction coil used in conjunction with a capacitor consisting of two flat metal plates across which a spark gap was connected; the receiver was a " coherer "—a small glass tube containing metal filings which cohered whenever a minute oscillatory current was applied across it and thereby provided a low-resistance path or switch for a local battery-operated Morse inker or telephone earpiece.

Marconi improved the various component parts—and particularly the coherer circuit—and added a Morse key to control his transmitter, finding, as he had expected, that messages could be sent and received. But he soon found, as all the scientists of the day had done, that the range of the signals was short; beyond a distance of 100 m or so the Morsed message was unreadable. What was the antidote? A more powerful transmitter? A more sensitive coherer? At first, Marconi elected for the latter and further improved his receiver, but with only marginal increase in range. Then, one day in 1895, while attaching a metal plate to his transmitter to add capacitance, he found that raising the plate above his head increased the range noticeably, while connecting the opposite side of the spark gap to earth improved matters still further. Hastily he constructed an antenna (consisting of a metal plate supported on a pole) for both transmitter and receiver, using also an earth connection at both. The increase in range was staggering; from a mere 100 m or so the signals were now reaching a distance of 1 km and further experiment brought this to 2.5 km.

At this point, father Giuseppe, who had hitherto regarded his younger son's activities with disfavour, relented and provided both moral and monetary support. It was decided to attempt to interest the Italian Government in the work but this proved abortive and, after a family conference, Guglielmo was sent to England where his cousin Jameson Davis had promised to help him contact people of influence.

The young man—he was 21—duly arrived in February 1896 and in the following June applied for his first patent. In the same month we find him demonstrating wireless telegraphy to William Preece, the then Chief Engineer of the Post Office. On 20 July 1897 the world's first radio company was formed with Marconi as its head. It began life as " The Wireless Telegraph and Signal Company " but this title was changed to " Marconi's Wireless Telegraph Company " in 1900, a styling which was retained until 1963 when the more manageable present form of " The Marconi Company " was adopted.

From 1896 until 1900, orders were virtually non-existent. Marconi had envisaged his apparatus primarily as a means of saving lives at sea, but both Trinity House and the shipping lines, although interested, sat on the fence (if maritime authorities can be said to do this). In 1900 the outlook brightened; both the Italian Navy and the Royal Navy placed substantial orders. The first paid-for installation in a mercantile fleet was an installation aboard the German liner *Kaiser Wilhelm der Grosse* (also 1900).

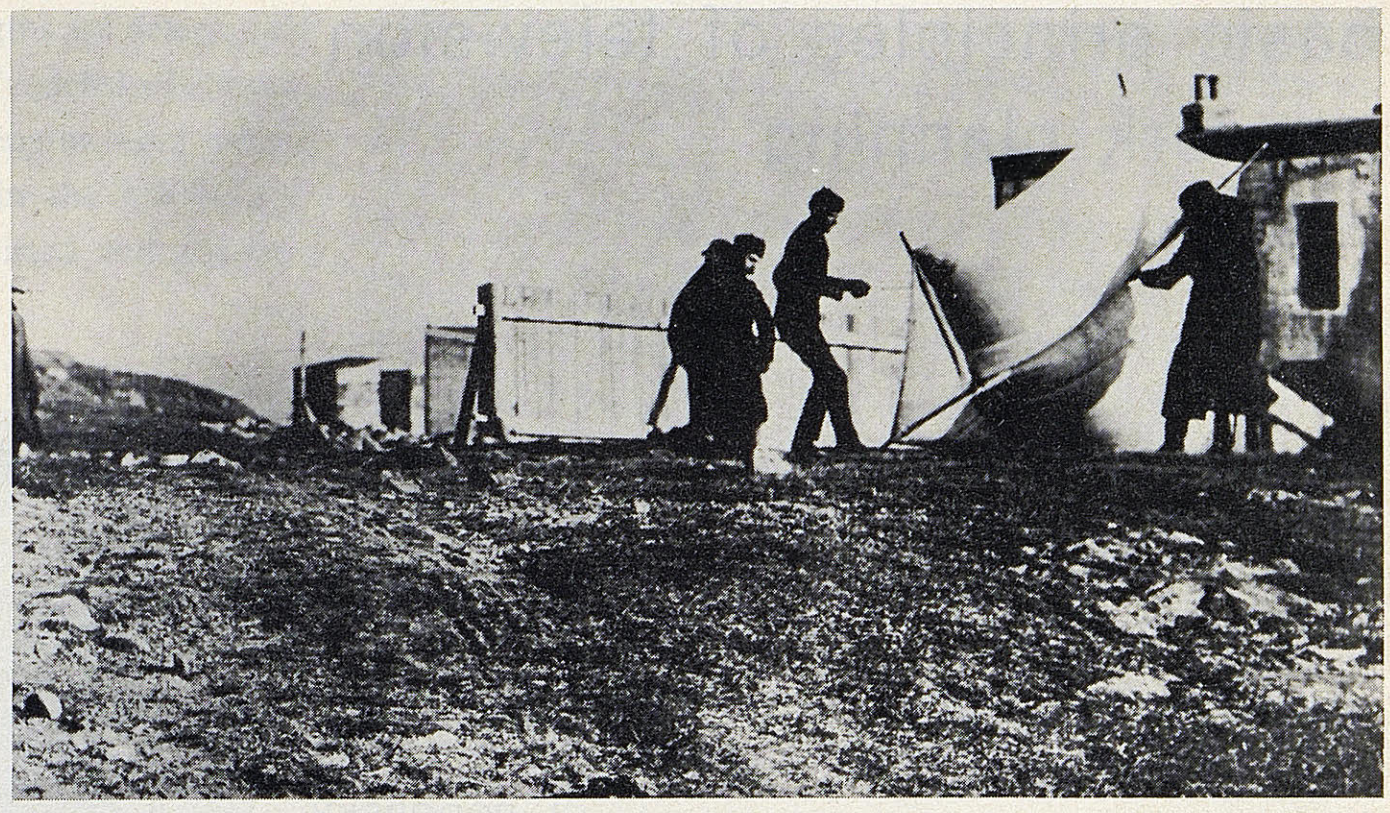
This early reluctance to buy was not solely conservatism, for early wireless telegraphy suffered from two major defects. Because

the signals were untuned they spread over a wide band of frequencies and two stations operating within close range of each other provided hopeless mutual interference. Furthermore, even under ideal conditions the telegraphy speed was painfully slow—ten words per minute was considered excellent—a circumstance which was occasioned by the sluggish operation of the coherer detector.

These problems had to be solved, and quickly. Tuning was the first to be tackled and this resulted in the " Four Sevens " (No. 7777) patent of 26 April 1900. Two years later Marconi developed his magnetic detector; this device trebled operating speeds to 30 words per minute; it remained as standard Marconi receiving equipment for a considerable number of years and is known to have been in use at sea until the 1920s.

In 1901, in the face of scientific opinion which declared the project impossible, Marconi, after a series of setbacks which would have daunted a lesser man, succeeded in spanning the Atlantic with wireless signals. In 1905 he developed the " bent aerial " directional antenna; the rotary disc discharger followed in 1906. All these were successive stages in the realization of an early ambition, namely to establish a thoroughly reliable two-way transatlantic service. This he accomplished in 1907, using super-power stations at Glace Bay (Nova Scotia) and Clifden (Eire).

By this time his Company was on a much more secure foundation, with orders coming in from all over the world. With its rapid growth came inventions and discoveries for which Marconi was not personally responsible except in the sense of being in overall charge; among these may be mentioned the thermionic diode valve, improved direction-finding techniques, improvements to the triode valve including its use in the transmitting role, the development of aviation radio communications and navigational aids, the initiation of sound broadcasting in Britain and the introduction of the Marconi-EMI television system in partnership with Electric and Musical Industries Limited.



(Marconi)

Raising the kite aerial at Signal Hill, Newfoundland, with which in 1901 the first wireless signal across the Atlantic was received from Poldhu (Cornwall). Marconi is the figure at the extreme left

By the 1920s two of Guglielmo Marconi's major ambitions has been realized; he had seen the world-wide application of radio to shipping, whereby innumerable lives had been saved, and he had extended the range of his high-power long-wave (low-frequency) stations to provide world coverage. One dream still remained, namely that Britain should possess an imperial wireless chain of stations which would link the nations of the Empire to the mother country. His first proposal for this had been made in 1906 but successive governments had, for various reasons, procrastinated. In 1924 yet another Committee was debating the matter when The Marconi Company put forward a startling new proposal. Hitherto the concept had always been in terms of huge long-wave high-power stations. Guglielmo Marconi and his assistant C. S. Franklin had, however, been investigating the curious skip-distance phenomenon which had been noted on short-wave (high-frequency) transmissions and had come to the conclusion that the short waves offered many advantages in terms of long-distance communication, particularly in terms of lower capital costs and greater technical efficiency. Much experimental work was done by Marconi and Franklin at high speed and in secrecy and in an astonishingly short time a practical system was evolved and offered to the British and Commonwealth Governments. The proposal was accepted and in October 1926 the first terminal stations of the Marconi-Franklin short-wave beam system were handed over to the British Post Office. Before long, the Empire was linked by such stations. Marconi's great ambition had at last been achieved.

He was now 52 and in the years that followed he spent much time cruising in his steam yacht *Elettra* which he had converted into a floating laboratory. Despite a heart attack in 1927 he persisted in his work, which was now chiefly devoted to ways and means of opening up the microwave bands for commercial and military applications. This proved to be his last contribution to the technology. During the 1930s the heart attacks became more frequent and severe but he still persisted in working. Then in Rome on 20 July 1937 came the final seizure. Guglielmo Marconi was dead, and the world mourned. The Italian radio services closed down completely for five minutes and in Britain the broadcasting and communications stations observed a two-minute silence, while throughout the British Empire the beam stations handled no traffic for that period. The radio silence which had prevailed before that first patent application of 1896, descended again in homage at the passing of Guglielmo Marconi.—*W.J. Baker—The Marconi Company Limited.*

basic principles of television network planning

by
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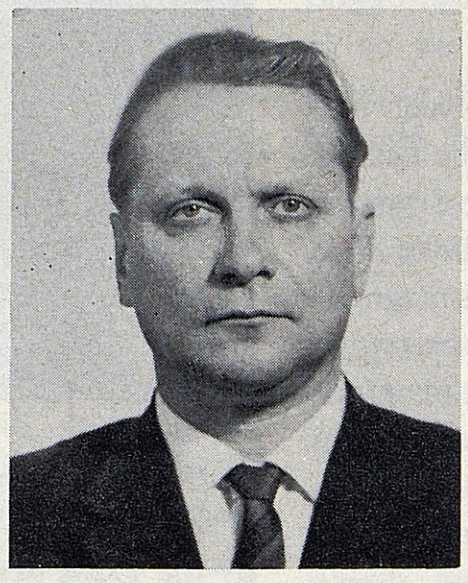


I. Introduction

Television and radio soon become part and parcel of everyday life. The development of television will inevitably play an important part in the future progress of mankind. The enormous speed with which many countries are expanding their television facilities, constructing television broadcasting centres, powerful relay stations, cable systems and radio-relay links for transmitting television programmes, coupled with the further improvement of the equipment in existing television centres, all call for the steady development and improvement of technical installations. It is therefore extremely important that television networks should develop along the right lines in all countries.

This report outlines the main principles which should be applied in planning television broadcasting networks. These principles, which call for the solution of a number of problems, are as follows:

— optimum siting of television transmitters;

— judicious use of frequency bands;

— definition of technical and economic characteristics of transmitting and receiving equipment.

II. Basic principles of television network planning

1. The work carried out in various countries, including the Soviet Union, has made it possible to apply scientifically founded mathematical methods in television network planning.

2. In the VHF and UHF bands field strengths are determined in relation to distance by the well-known Vvedensky formula. Graphs for determining median field strengths were subsequently published in scientific journals in the USSR and other countries. These graphs were submitted and adopted at the Stockholm Conference in 1962.

3. In designing television networks, it is necessary to aim at an optimum plan. Such a plan should provide for a given quality of television broadcasting in a specific area at the lowest possible cost.

4. The quality of television broadcasting is expressed by the percentage of time ($T\%$) for which the technical characteristics of transmitting and receiving equipment make it possible to obtain a signal of satisfactory quality at a given percentage ($<\%$) of receiving points.

If the transmitter and receiver parameters are assumed to be stable, then the propagation path will be the only element in the chain liable to introduce random variations. Thus the field strength at the receiving point can be derived from the following formula:

$$E(p, q) = P'_{\Sigma} + E(50, 50) + Z(q) + Z(p) \qquad (1)$$

where

$E(p, q)$ = the field strength for the distance r (km) from the transmitter, expressed in dB with reference to 1 μV/m

$P'_{\Sigma} = 10 \log P_n + G - P_f$ in dB, with reference to 1 kW

P_n = power applied to transmitting antenna feeder in kW

P_f = power of feeder losses in dB, with reference to 1 kW

G = transmitting antenna gain in dB, with reference to half-wave dipole gain

$Z(p)$ and $Z(q)$ = functions, determined for central values of random variables when $q = p = 0.5$, clearly $Z(p) = Z(q) = 0$

$E(50, 50)$ = median field strength at distance r (km) from the wanted transmitter with an equivalent power of 1 kW.

Experience shows that the field strength at the receiving point follows a lognormal distribution law. It follows therefore that the field created by a transmitter at a receiving point may be readily determined if data are available on the transmitter parameters, the laws governing the field strength at the receiving point as a function of time and local conditions, and the distribution curves for $E(r)$.

The reception quality depends on the field strength at the receiving point, and will be the higher, the greater the field strength. For this reason, in compiling the optimum plan, the field strength value E_{min} must be chosen which will ensure the required programme reproduction quality. This value E_{min} depends on the television set characteristics, the standard adopted for television sets, cosmic noise and other types of interference.

In Bielorussia, as in the other Republics of the Soviet Union, the following field strength limit values are adopted:

for channels I and II: 315 μV/m
for channels III to V inclusive: 500 μV/m
for channels VI to XII: 700 μV/m
for UHF: 3100 μV/m.

Research has been carried out recently in the Soviet Union on UHF propagation conditions in a large city with a view to determining the technical possibilities for UHF network planning. In addition to solving particular problems, this research showed that, in comparison with VHF, the UHF field strength values must be greater, in areas with:

a) low density of buildings: by 4.5 dB
b) medium density of buildings: by 8.25 dB
c) maximum density of buildings: by 13.0 dB.

Taking into account the figure adopted in cities for the minimum VHF field strength which ensures the necessary quality of television signal reception, i.e. 5 mV/m, a field strength of at least 15 mV/m will on average be necessary for television sets working in UHF with a single frequency conversion.

In compiling the optimum plan for television coverage, it is essential to determine the effective transmitter utilization φ, which represents the useful area per unit of transmitter power in an interference-free channel $\varphi = S/P_{\Sigma}$.

Similar parameters should be introduced to cover the case of interference between stations in the television network which is being planned. The first step is to determine the minimum permissible distances between co-channel transmitters in an ideal network, in which the useful area of each transmitter is maintained in the presence of mutual interference. These

distances can be derived from the protection ratios, which in turn can be determined from subjective statistical analyses, and which depend on the technical characteristics of the television receivers. Research work carried out in the USSR on protection ratios showed that, in most cases, they correspond to the parameters given in the Stockholm Plan for both black-and-white and colour television. It should be noted that the entire Soviet network, including Bielorussia, is designed to transmit colour television programmes using the *Secam III* system jointly developed by French and Soviet scientists.

When the protection ratios are known, it is easy to determine the minimum permissible distances between transmitters using shared channels and transmitters working in other frequency channels in cases where it is impossible to divide channels so as to avoid mutual interference.

In such cases, apart from interference between transmitters operating in adjacent channels, account must be taken of interference caused by the intermediate frequency of television sets and also by their design and construction; the characteristics of receiving antennae also affect these distance values.

Since it is by no means an easy matter to estimate the minimum distances between transmitters and the useful area of each transmitter, Soviet designers have developed a programme for solving all these problems by computer.

In network planning, the minimum number of frequency channels may be derived from the formula:

$$C_{min} = \frac{D^2_{min}}{3\, d^2_{eff}}$$

where

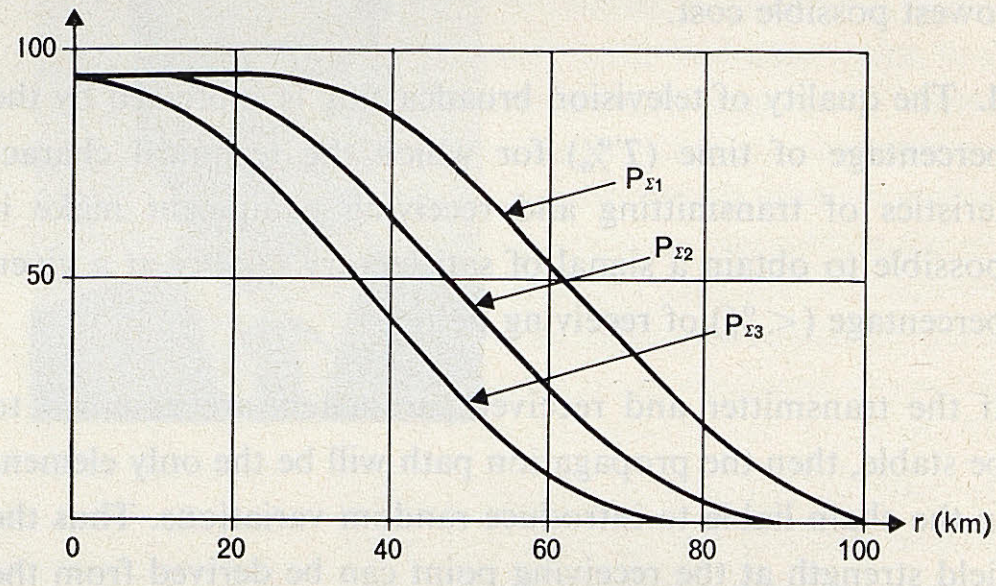
D_{min} = distance between co-channel transmitters determined for given protection ratios;

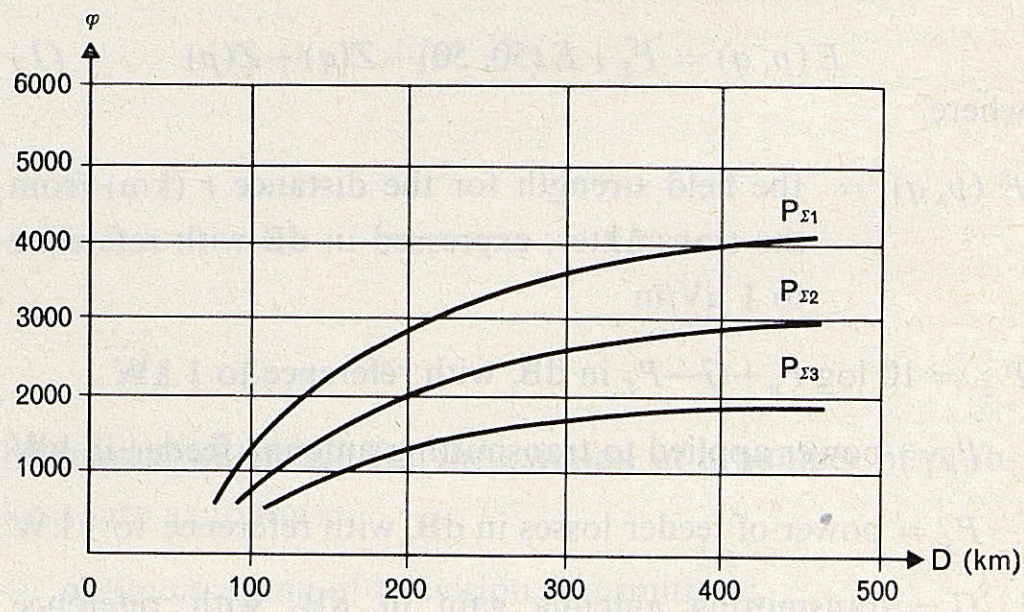
d_{eff} = radius of useful area.

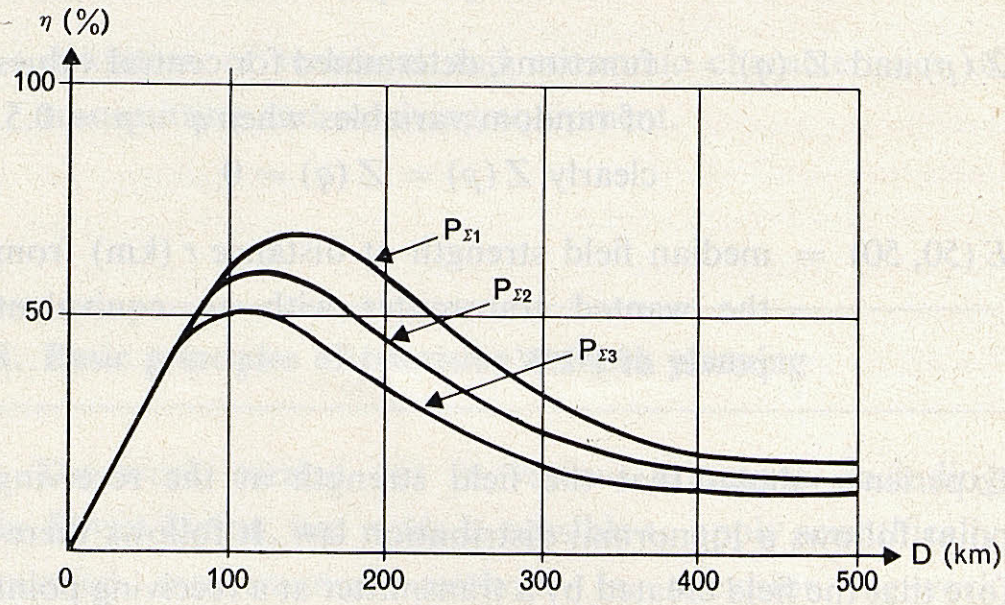
In planning, it is often necessary to estimate the effective value of area S_{eff} and then the effective utilization of frequency channels η, which characterizes the ratio of the useful area of the transmitters at the apices of a triangle of shared frequency channels to the whole area of the triangle S_Δ

$$\eta = \frac{1}{2} \times \frac{S_{eff}}{S_\Delta}$$

Annex 1 contains sample distribution curves of reception quality K, the effective transmitter utilization φ and the effective utilization of frequency channels η as a function of the minimum distances.







Annex 1

The attached graphs may be an aid to network planning, in that they may be used to estimate and select the optimum variant, which will of course ultimately be a compromise.

In conclusion, it should be pointed out that the complete calculation of a network is not easy even by computer. We have therefore compiled special tables which can be used for the more rapid evaluation of the possible relations which characterize the economic parameters of television networks.

III. Some problems connected with the development of television in the Bielorussian Soviet Socialist Republic

This part of the report discusses problems directly connected with the introduction of television in the Bielorussian Soviet Socialist Republic.

In setting up the television plans, we were faced with the task of covering the entire territory of the Republic with two-programme broadcasting and providing the capital with a four-programme service. This work was scheduled for completion in two stages, the first stage relating to the coverage of the whole territory of the Republic with one-programme television broadcasting. In compiling the plan, the Bielorussian Ministry of Posts and Telecommunications was guided by the Stockholm Plan of frequency channel allocations and the operative International Radio Consultative Committee (CCIR) recommendations. The Ministry aimed at the most rational allocation of television channels throughout the territory of the Republic, applying the smallest permissible distances from the television stations to the confines of the service area of neighbouring television stations sharing the same channel.

The 625-line system is used for black-and-white television and colour television in the Soviet Union, including Bielorussia.

At present, VHF television stations for bands I and III and powers of 50/15, 25/7.5 and 5/1.5 kW, low-power relay stations (0.1/0.03 and 3.0/1.0 kW), and stations with powers of 25/7.5 kW for bands IV and V are designed, manufactured and widely used in the Soviet Union.

Many complex problems were solved connected with the design and construction of the 50/15 and 25/7.5 kW stations. The chief feature of this type of station is the use of two independently operating half-power transmitter units, in both the video channel and the sound channel. Power addition of the two units is effected by a bridge. A filter common to both half-units is connected to the bridge output and serves to eliminate the higher harmonics. The video and sound transmitters have a common antenna feeder to which a bridge-type VHF antenna filter is connected. The 5/1.5 kW stations have a similar design.

The low-power (100 W) relay stations are operated by remote switching, and monitoring devices are provided with complete stand-by equipment. There are also unmanned 3 W relay stations.

The stations designed for television broadcasting in bands I and III with powers of 50/15 kW and mast heights of 300 m can transmit good-quality television programmes in an area with a radius of up to 100 km and the stations with powers of 5/1.5 kW and mast heights of 200 m can transmit good quality television programmes in an area with a radius of up to 60 km, while the low-power relay stations (0.1/0.03 kW) with mast heights of up to 100 m are intended for television broadcasting in small areas with a radius of up to 10-12 km or in individual populated localities.

The 25/7.5 kW stations are designed and manufactured for television broadcasting in bands IV and V. They can transmit good quality television programmes in an area with a radius of 40 to 45 km.

Television masts are 100-300 m high. In planning television services, the following points affect the choice of the mast height. Firstly, the mast should be as high as possible for the purpose of covering a larger area. Secondly, a low mast is inacceptable in view of the need to ensure the biological protection of operating staff against excessive electromagnetic radiation. Biologically harmful areas can be determined from the total power flux density on the ground near the mast.

The power flux density for video and sound transmitters separately can be derived from the formulae:

$$\rho = \frac{E^2}{3.75} (\mu W/cm^2)$$

: d

$$E = \sqrt{30\,P\,(\mathrm{W})\,\eta\,G}\,\frac{F(\Delta^\circ)}{R\,(\mathrm{m})}\,(\mathrm{V/m})$$

where

1) $P = 0.5 \times P$ video (power when a video signal of mean level is transmitted)

P video = the peak video transmitter power

2) $P = P$ sound (sound transmitter power)

η = feeder efficiency

G = antenna gain referred to an isotropic antenna ($G = G_n \times 1.64$)

G_n = antenna gain referred to a half-wave dipole

$F(\Delta^\circ)$ = standard coefficient of directivity diagram in the vertical plane

R = distance from the phase centre of antenna to receiving point.

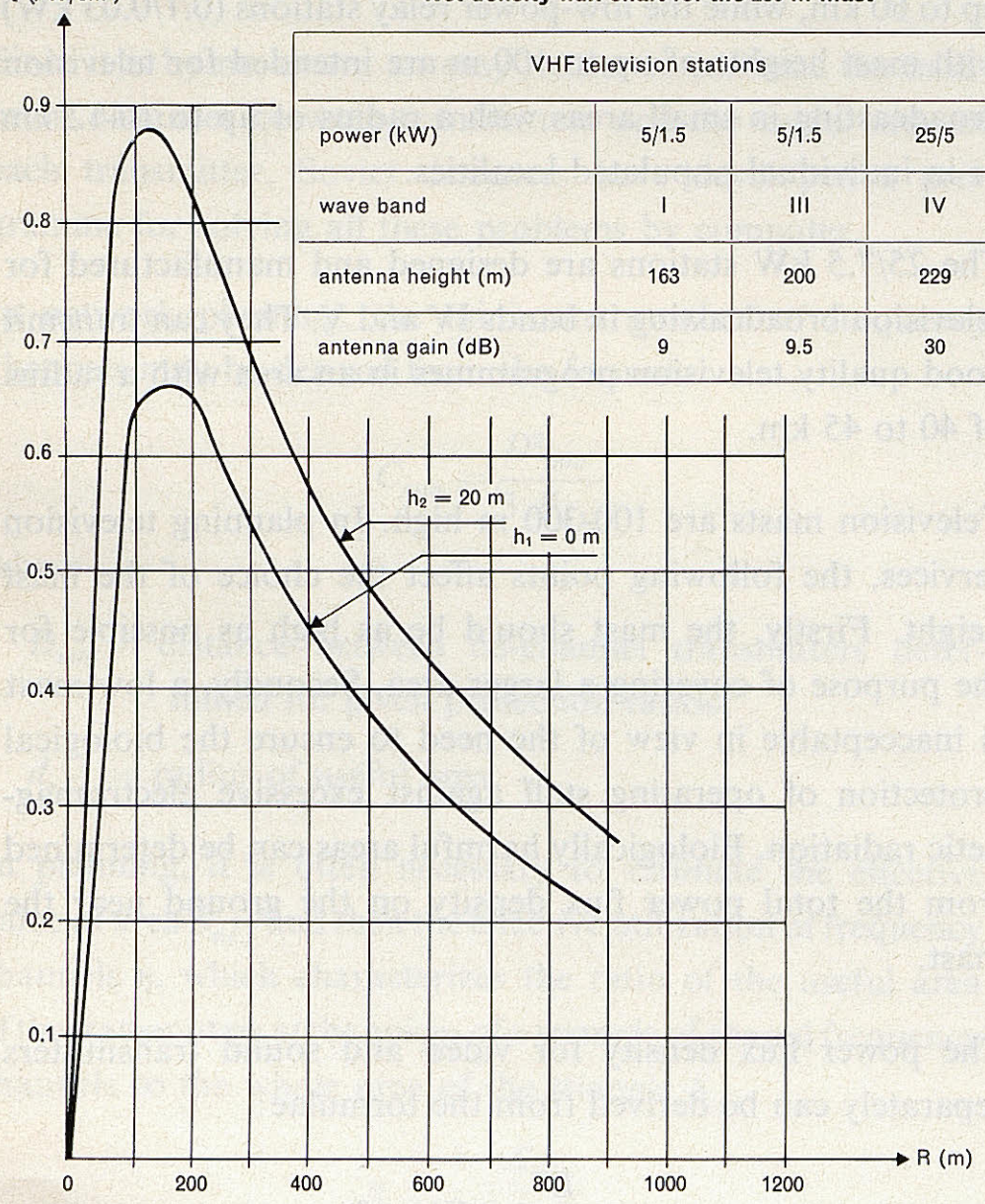
Graphs showing the power flux density when the antennae of three transmitting stations are placed on one mast are attached as annexes to this document for purposes of illustration (annexes 2 and 3). In the second annex, the antenna mast height is taken as 230 m and in the third annex as 125 m. The curves are plotted with observation point elevation values of $h_1 = 0$ and $h_2 = 20$ m.

According to the regulation health standards applied in the Soviet Union, including Bielorussia, the permissible radiation level for operating personnel in the VHF range is a field strength value of 5 V/m, which corresponds to a power flux density of $\rho = 6.7\ \mu\mathrm{W/cm^2}$, and in the UHF range $\rho = 10\ \mu\mathrm{W/cm^2}$.

Hence, it can be concluded from the diagrams that the total power flux density at a distance of 100 m from the 125 m high mast exceeds the health standards, while for the 230 m mast the total power flux density is well below the permissible value.

Net density flux chart for the 230 m mast

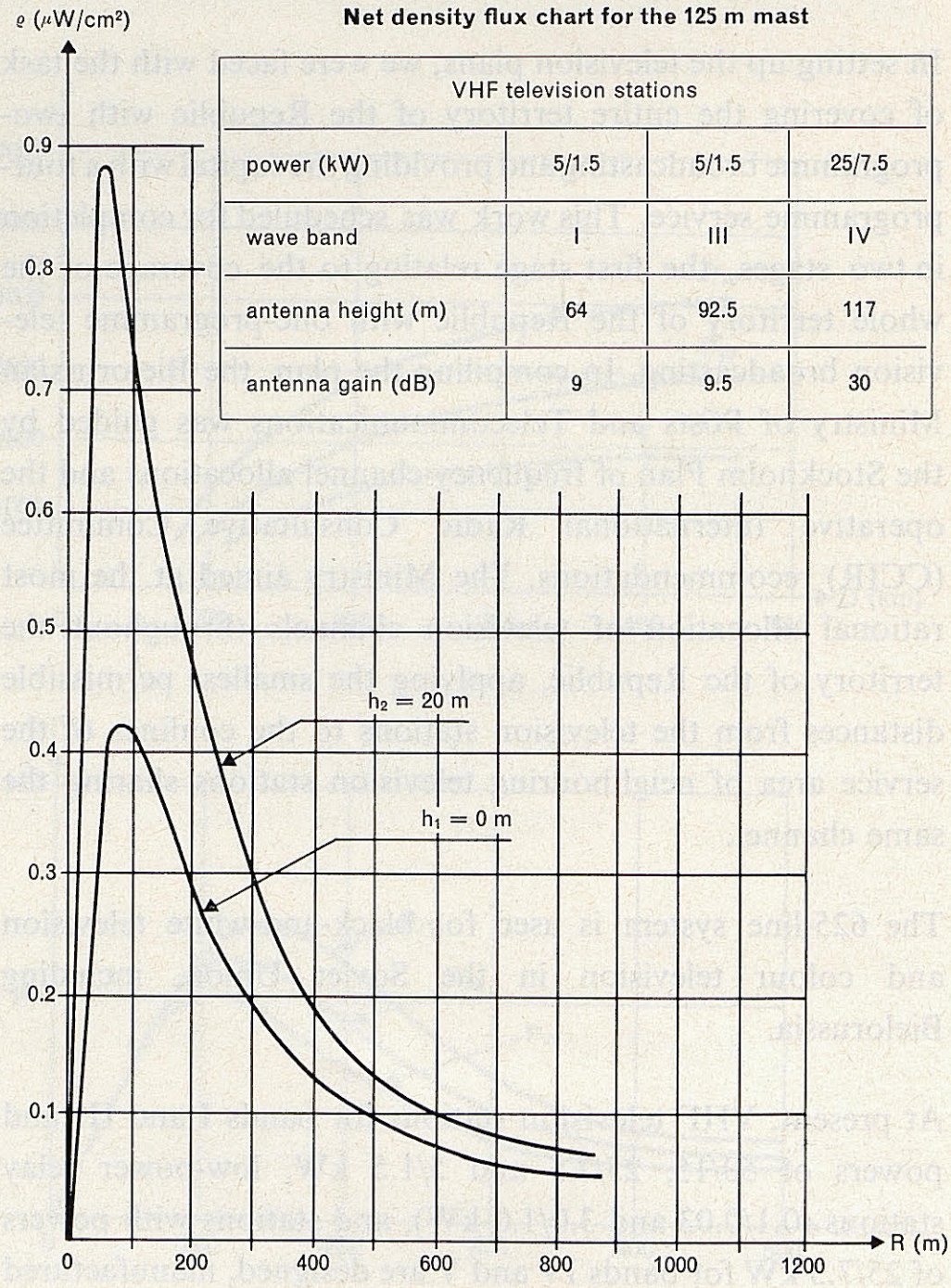
VHF television stations			
power (kW)	5/1.5	5/1.5	25/5
wave band	I	III	IV
antenna height (m)	163	200	229
antenna gain (dB)	9	9.5	30



Annex 2

Net density flux chart for the 125 m mast

VHF television stations			
power (kW)	5/1.5	5/1.5	25/7.5
wave band	I	III	IV
antenna height (m)	64	92.5	117
antenna gain (dB)	9	9.5	30



Annex 3

Clearly, the best mast height for a television antenna is 230 m, since a mast height of 125 m will mean a television broadcasting radius 1.4 times smaller and a halved television broadcasting area.

For more effective biological protection of operating staff against radiation, it is necessary in some cases to calculate the minimum height of the antenna on the mast.

In selecting equipment for television transmitting stations, it may be considered advisable to mount antennae with a power of 50/15 and 25/7.5 kW on 250 to 300 m masts, transmitting station antennae with a power of 5/1.5 kW on 150 to 200 m masts and 100 W relay station antennae on 100 m masts.

Therefore, in order to cover the entire territory of the Bielorussian Soviet Socialist Republic, i.e. 214 000 km² with one-programme television broadcasting, the following equipment had to be used:

— 5 television transmitting stations with a power of 25/7.5 kW and masts with a height of 300 m;

— 9 television stations with a power of 5/1.5 kW and masts with a height of 150 to 200 m;

— 4 low-power relay stations and masts with a height of 100 m.

The whole area of Bielorussia is now covered by one-programme television broadcasting. Work is in progress aimed at two-programme coverage and the use of UHF transmitting stations is planned.

To comply with approved protection ratios, we made all VHF transmitting stations work with offset (Soviet experts helped to compile the offset plan in 1962).

To ensure compliance with the standards adopted, we have set up a monitoring service in the Republic which monitors VHF and UHF frequency stability, radiated power, noise and other factors relating to television station operation.

In conclusion, we should point out that an analysis of VHF television station construction costs shows that it is more economic to use high-power transmitters and very high antenna masts. The figures show that, by using transmitters with a power of 25/7.5 kW and 300 m masts, we arrive at costs per square kilometre of useful area which are 25% lower than the costs of transmitters with a power of 5/1.5 kW and 200 m masts. Operating costs also appear to be 20% lower.

Theoretical considerations indicate that it is even more economic to use antenna masts over 300 m high, but this may cause interference to stations in other countries. In some cases, therefore, we are compelled to refrain from using higher masts in order to comply with the Stockholm Plan.

(Original language: Russian)

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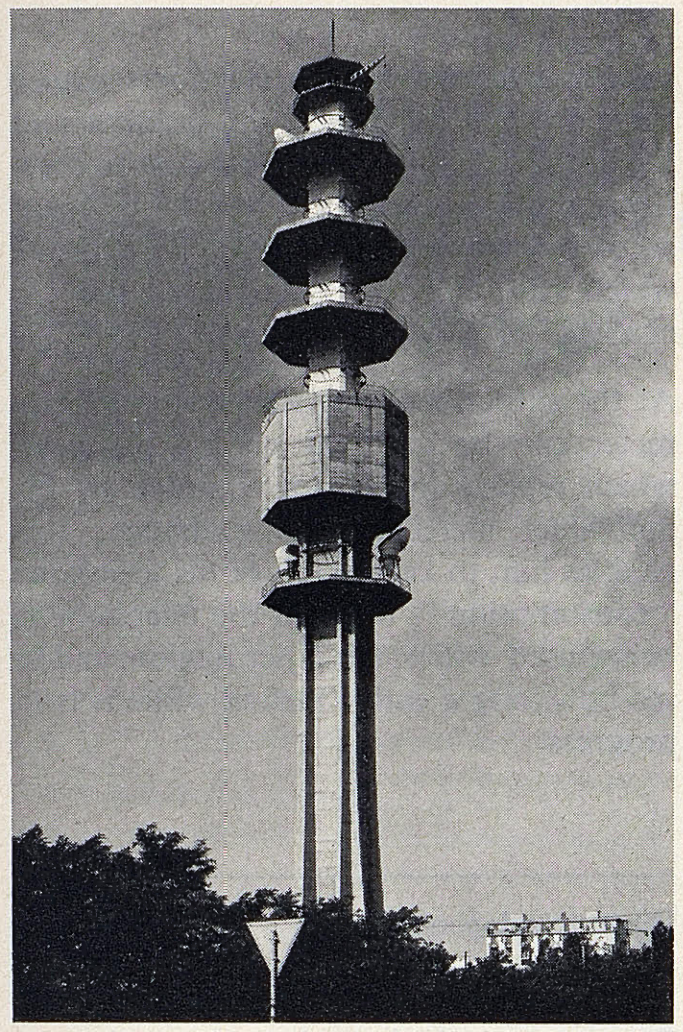
subscriber trunk dialling in italy today

by
G. BENEDETTI
Società italiana per l'Esercizio telefonico p.a. (SIP)
Italy

The recently completed extension of subscriber trunk dialling (STD) to the entire country is the most important development in the Italian telephone service since the post-war reconstruction. It is an event of outstanding significance which puts Italy among the first five countries in the world to achieve this target and gives a true mesure of the progress made in the Italian telephone service.

Now that it is nation-wide, subscriber trunk dialling must rank as a new service and not merely as an extension of something that already existed, on a greater or smaller scale, in all localities. This vast operation, which was carried through in only 30 months, has revolutionized the techniques employed hitherto since it involved a massive application of electronics. What this means can be briefly summarized by saying that previously telephone exchanges routed subscriber dialled calls by systems which might be described as " instinctive "; today, owing to the complexity of the automatic operations rendered necessary by the size and ramifications of the network, routing requires the intervention of an " intellect ". As a result, telephone exchanges tend more and more to resemble computers, by the number of fully automatic operations they have to perform according to specially prepared programmes and by the speed at which these operations are carried out. For any call between two localities at some distance apart there is a whole range of possible routings; this ensures the rational utilization of technical equipment, gives the entire system greater flexibility and gives subscribers a better guarantee of uninterrupted service. A single example will suffice: an STD call from Cuneo to Savona can be routed directly between the two towns, or via



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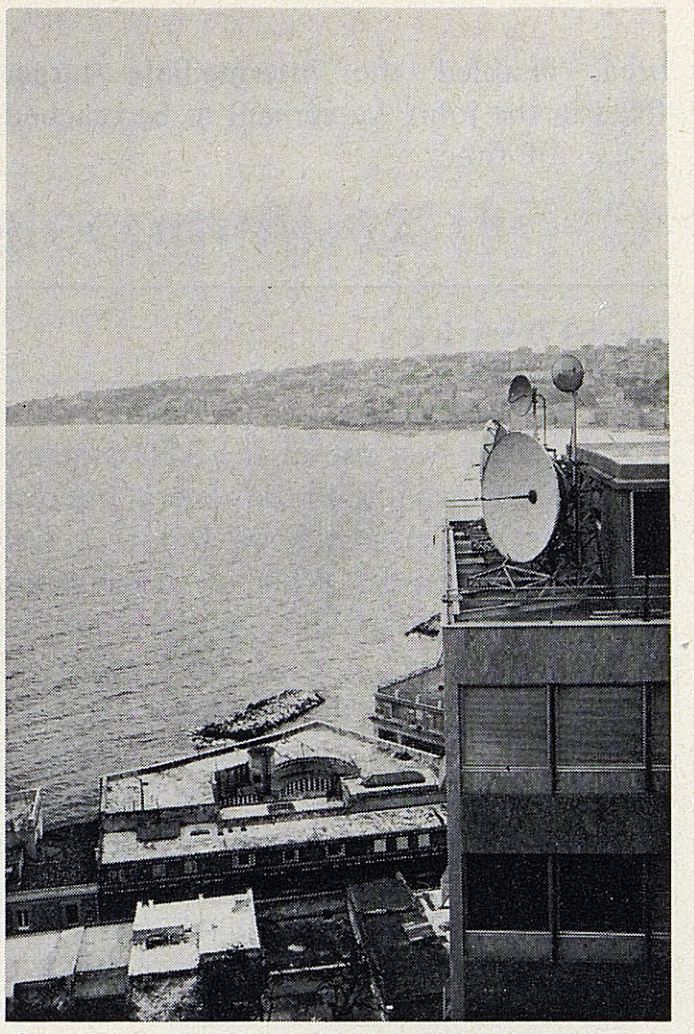

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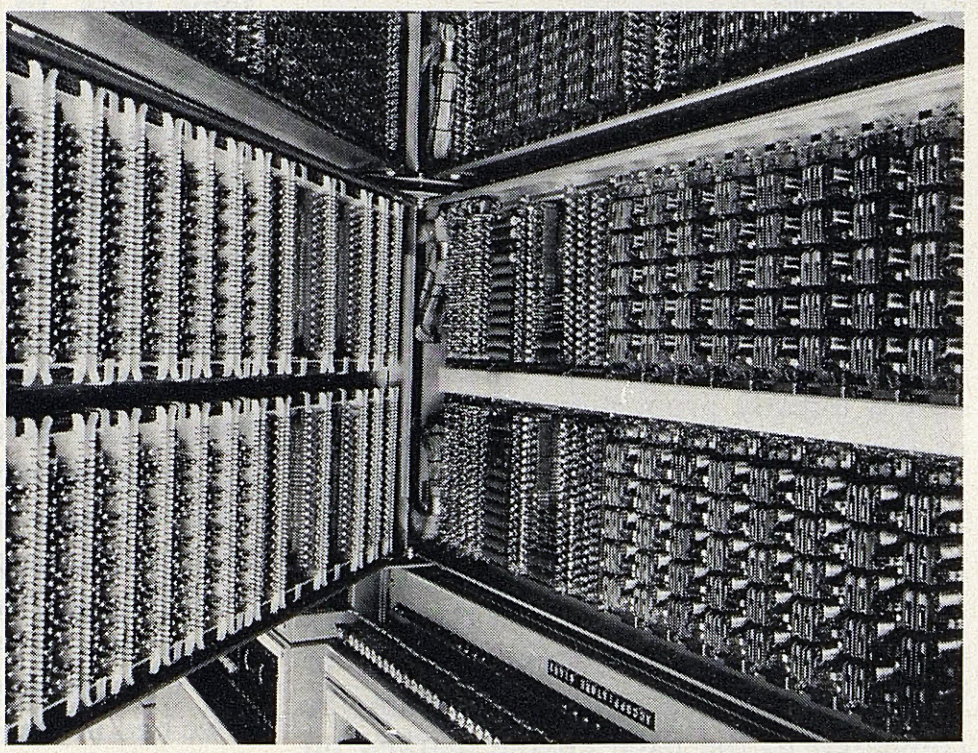

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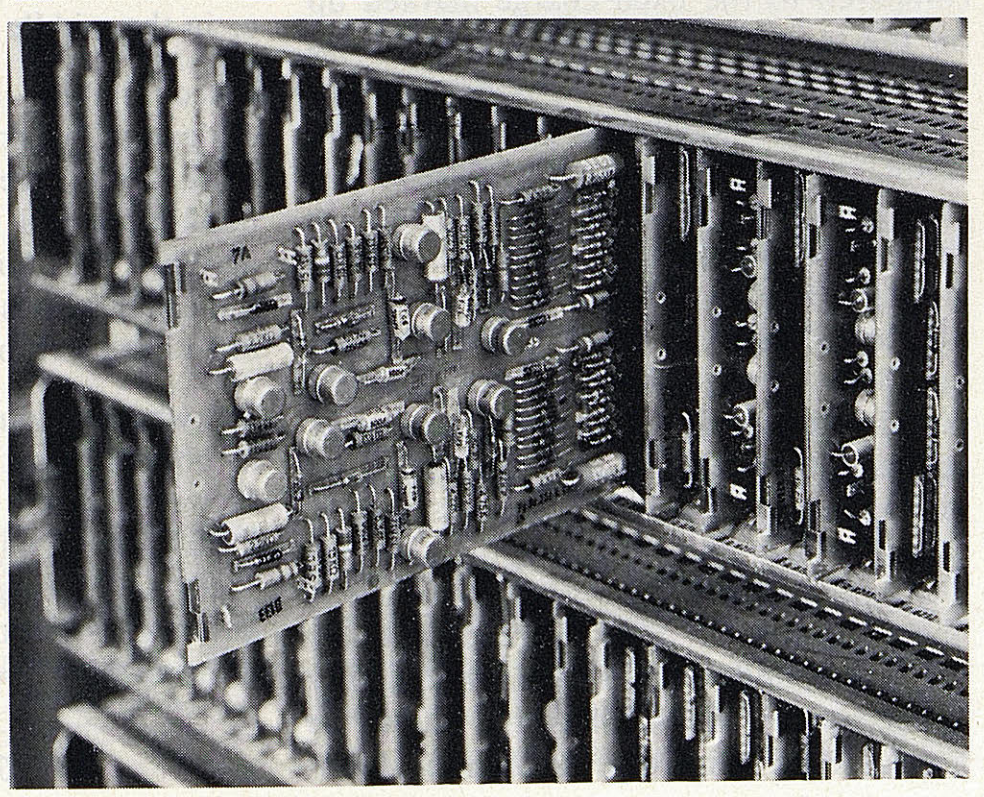

4.

1.
The 105 m-high radio tower at Milan-Pero
(R. Zabban, Milan)

2.
SIP terminals of radio links over the Bay of Naples
(Studio Vanzetti, Rome)

3.
Hinge-mounted ESK-relay shelves in the connection stage of a trunk switching centre of the Italian long-distance network
(R. Zabban, Milan)

4.
Partial view of the electronic routing and charging equipment in an automatic trunk switching centre of the Italian long-distance network
(Industrial Foto, Milan)

Genoa, or via Turin, or via Turin—Genoa, or, finally, via Turin—Milan Turro—Genoa. Thus we have a series of routes which are " hunted " in turn in a few thousand-millionths of a second.

The device which constitutes the " brain " of the system is the translator-routing-charging unit (*TIT—traduttore-instradatore -tariffatore*). Each such unit has a high logic and storage capacity; it is able to control up to 1500 trunk circuits and to record automatically faults in installations and the amount of traffic handled.

Vis-à-vis the fully automatic network any subscriber is in the position of a " sorcerer's apprentice " who, by dialling a simple prefix and number sets in motion, often without realizing it, a whole world of forces of which he knows nothing, but which do not run riot in chaotic fashion because they are subject to a perfect control system which directs them towards the desired end.

The fully automatic network

The whole automatic network is composed of 53 130 relations, which is the number of possible combinations for linking in pairs all the 231 telephone districts into which Italy is divided. To build up a homogeneous network, work had to be done in all the districts and in every exchange composing them because every locality was fitted out with the same equipment, varying only in quantity according to the volume of traffic, but not in quality. The numbers of relations progressively brought into operation give a good idea of the nature of the enterprise: the 7360 relations in operation in April 1968, i.e., at the time of the entry into force of the new demarcation of competence between the two bodies responsible for running the trunk service (the *Azienda di Stato per i Servizi Telefonici* and the licensed company *Società italiana per l'Esercizio telefonico p.a.*—SIP), had increased to 8099 by the end of the year, to 14 898 at the end of 1969 and to 51 798 at the end of October 1970. To these must be added the relations in, or brought into, operation by the Azienda di Stato. The completion of these stages, and the simultaneous introduction of subscriber trunk dialling in each district and later in each area, enabled the intermediate target fixed in the joint Agreement to be reached ahead of time.

The STD service

To make the best use of the STD system, it is in their own and in the general interest for users of the service to follow a few simple instructions. When a caller stops dialling in the middle of the number because he is not sure of the number or prefix he wishes to dial, telephone equipment and circuits are uselessly occupied and cannot be used for other calls. A little care in verifying the number under its appropriate entry and the prefix in the list at the end of the telephone book, could avoid this. Repeated calling of a number when the busy signal is received has the same effect; it is best to wait a few minutes before dialling again.

Charging for the automatic service

Subscriber trunk dialling is particularly convenient for short calls because its cost is directly proportional to the length of the conversation. The tariff applied consists of two parts both of which depend on the distance: the answer pulses—up to four, for distances of over 350 km—and the periodic pulses at intervals of 20 s maximum and 5 s minimum. By way of illustration, the answer pulses can be compared to the fixed charge marked up on the taximeter when the driver lowers the flag; the periodic pulses correspond to the length of the journey or waiting time. Both types of pulse are recorded by the meter at the exchange. In contrast to the other public services (gas, water, electricity) with mains which serve a number of users, so that a meter must be installed at each house representing a consumption point, every telephone subscriber is connected to his exchange by an individual line and his " consumption " is carried out at the exchange, once he has dialled the number he wishes to call. It is important also to bear in mind that, for the other public utilities, a single quantity (cubic metres, litres, kilowatts) has to be measured to determine the amount consumed, whereas in the telephone service there are two quantities, the distance and the duration, which vary from case to case. Consumption, therefore, has to be measured by complex and delicate instruments which can only be installed at the exchange.

At the subscriber's request, a subscriber's meter can be installed on his premises, which repeats the pulses recorded by his individuel meter at the exchange; this enables him to keep track of his telephone " consumption ", to see if the telephone is being used without his permission and to see how long a call is lasting while it is in progress.

When to telephone

The urge to telephone in order to impart some news, to hear a friend's voice or simply to " have a chat " springs up unbidden in the human breast and we feel the need to satisfy it at once. We seize the receiver and dial the number. But is this always really necessary? Perhaps sometimes it is, but more often it certainly is not. There are times of day when it is best to telephone, especially for personal or private calls, because then the service is better. Let us therefore avoid the peak hours in the morning and the afternoon, when business traffic is at its height, and choose quieter periods when, apart from anything else, we can be sure of finding the person we wish to speak to at home and with more leisure to listen to us than if we had interrupted him during a meeting or in the middle of some important job.

Direct dialling by the subscriber is not obligatory when making a trunk call: there always remains the possibility of booking a call through the operator by dialling " 10 " or " 14 ", especially when the caller wishes to make an appointment or to have a record of each call.

But whether you are calling automatically or booking a call, the use of the telephone between certain hours—from 11 pm to 7 am on work days and all day on holidays —costs about half the normal rate. From Saturday afternoon to Monday morning is the telephone service's " long week-end ".

(Original language: Italian)

some problems of telecommunications training in africa*

by
A. H. BROOKS
General Secretariat, ITU

1. Introduction

THE problems of training in the telecommunications field are not in fact peculiar to telecommunications, and any suggested solutions can be thought of as relevant to similar situations in other specialized fields of technological development. New technologies of this kind share some special features which can be identified by examining the investments made in them by national governments and the relation of these investments to the gross domestic products of the countries concerned. Studies carried out by the International Telecommunication Union (ITU) in 1967 for the telecommunication sector—which we are here taking as an appropriate example of a technology—demonstrate the high cost of providing a unit of service to the consumer, amounting on a very rough average to about 1000 US dollars per main telephone line connected. The telecommunications industry is therefore hungry for capital, firstly because of the worldwide demand for telephones, and secondly

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because the machinery and equipment needed to provide a service is not only costly but shared *pro rata* over a limited number of subscribers. On the other hand, the ratio of gross telecommunications investment to gross domestic product in a wide range of countries is low compared with similar ratios derived for the " heavy " sectors of the infrastructure, such as roads and railways.

On a national basis, therefore, the cost *per capita* of providing a national telecommunication infrastructure is comparatively low, but the investment per line in cash terms is high. The equipments in use are complicated and need to be maintained to a high standard by fully trained personnel if they are to work well and thus protect the operating revenue earned, hopefully, from satisfied subscribers. It is therefore of overwhelming importance that we make an additional invisible investment in training —not in raw materials or heavy capital goods, but in people—and that we train in a manner to suit our purpose.

2. Investment in education

In the ITU we are conscious of the role telecommunications can play in the economic development of Africa. We know there is an interdependence between a demand for communications and economic development. On the one hand the demand only arises when a certain economic level is reached. Conversely, certain basic communication facilities are essential to continued economic progress. As the process of urbanization takes place the demand for facilities based on technology increases and at the same time the educational system becomes more and more incapable of meeting the demands made upon it. We are all aware of the difficulties which arise —the chronic shortage of teachers, the inability to provide adequate school buildings and technical installations, the human factors which enter into play when a country boy who has never seen a telephone is recruited, on the basis of a school certificate, for training in an unfamiliar technological world. Unfortunately, and for reasons which are compelling, most developing countries have to improvise, to adopt an immediate approach based on experience in already developed countries, to take risks on the way things turn out, usually with unfortunate effects on the delicate telecommunications equipment with which we are concerned. The basic difficulty is that of defined national needs, and of ensuring that an adequate part of investment is devoted to technical education in the face of imperative demands for the diversion of resources to agriculture, health, rural development and other well-known priorities.

It is very easy to buy a *Boeing*, but quite another matter to train a crew to fly it and to make it pay its way. It then becomes difficult to give the crew time off so that they can be kept at the peak of their flying perfection and, if necessary, trained to fly a *Concorde*. Similarly, in telecommunications, it is fairly easy to find money for equipment to provide a circuit for which there is a public demand. How difficult it is, on the other hand, to find technicians to maintain the equipment so that it gives good and reliable service and encourages the user to ask for more—and so to make a profit for the operating administration, for we must not forget that telecommunications can be a very profitable business. However, it may well be that the scale of investment required will alarm an administration which is starting to assess its national objectives in the technological field. In a well developed country with a population as large as that of Nigeria a typical telecommunications administration might have an annual training expenditure of 5 to 10% of its overall wages bill—expenditure which it would be very easy to label " unproductive " or " non-profitable ". Some 5% of the staff in post would always be undergoing training of one sort or another, and there would be a permanent teaching staff amounting to about one instructor for every 200 men in the total labour force. These quasi-ideal conditions do not exist anywhere in Africa and, in particular, it is rare to find a permanent staff of instructors engaged in full-time teaching. In human terms the educational burden of technology is impressive. A professional engineer may require 18 years full time education before he is ready even to start productive work, and the highly skilled technician, the backbone of a telecommunications structure, a minimum of 13 years academic and vocational training. Moreover, in a rapidly developing technology, it is impossible to stand still. As new and sophisticated equipments come into use it is essential to re-train the in-service technician, to broaden the basis of his professional knowledge and so to increase the productive capacity of the individual and the organization for which he works.

3. Productive output versus training investment

It is interesting to consider that the successful creation of a four-man team able to install a simple item of telecommunications equipment might involve an investment in about 11 training courses: four induction courses for the new recruits, four trade courses for the workmen, two courses of specialized training for the fitters and one supervisory course for the foreman. It is extremely difficult under present African conditions to protect this investment. Firstly, there is a very high wastage and drop-out rate during and just after training due to inefficient methods of selection and recruitment. It is desirable that new recruits be properly screened by means of psychological tests and preliminary courses designed to test their aptitudes for technological work and, extremely important, to inform them of what telecommunications engineering is all about. Secondly, it is the exception rather than the rule for African countries to carry out effective manpower surveys to identify the medium and long-term needs of potential employers. In the absence of manpower planning, designed to provide a reference on which to base the extent of a training effort, it is impossible to guarantee that the productive efficiency of a given programme will be a maximum, and that the investment we make in training

an individual—which is always a form of gamble—will pay off. Moreover, it is very difficult in these conditions for governments to establish permanent career structures and thus to provide the student with a guarantee of continued employment and a consequent feeling of security whilst he makes the considerable personal effort to acquire the qualification for his trade. We should not forget that, in a sense, a technological trainee is not a normal academic student or pupil. The latter is not yet oriented within a particular professional framework—a telecommunications trainee has in fact already chosen his profession and should be made aware that any training investment we make in him is designed to be productive over a long and well defined career. Thirdly, it is a common experience both in developed and developing countries to find that the education and degree of training of individual technicians tends to be pushed far above that required for the duties of their jobs.

This is particularly the case in those developing countries which have adopted training syllabuses from developed countries, and consequently tend to look to advanced academic standards of achievement as an end in themselves without defining their relation to the present needs of development. These countries tend therefore to over-invest in technical education. The result is that technical personnel find themselves highly trained academically but unable, due to lack of experience, to aspire to the level of employment for which they feel they are qualified. This is a common cause of dissatisfaction, of frequent departure to another job possibly outside their specialized field altogether, and at the least of frustration and lack of productivity. Hence the importance of routine job analysis as a preliminary to training—to ensure that pupils are selected on a correct psychological and educational basis and trained to just the right degree—not too much, and not too little.

Finally, we should not overlook the intense interest of African workers' unions in training and career structures. If it can be seen that management is paying serious attention to the fundamental problems of recruitment, training and career prospects, the unions may feel assured that their two major aims—satisfactory employment conditions and prospects and advancement—are being properly cared for. A happy trade union makes for a happy management and naturally, for a productive organization.

4. Technical education and job training

A government which has decided on a training investment will know that there are two basic elements in a technological training programme, namely, technical education and job training. In telecommunications we find that a considerable proportion of recruits to our special field need preliminary conditioning in such subjects as mathematics and science before they are able to enter on a job training programme. In a technological world it is obvious that special attention needs to be paid to science subjects, although we know the difficulties this entails with regard to the provision of teachers, and costly training equipment. In addition, all governments have a responsibility to provide facilities for further education at the post-secondary level, in an effort to elevate the general technical standards of the working population. We believe it important that the staff of a telecommunications organization be given every encouragement and inducement to acquire further educational qualifications, but equally important that the educational facilities offered bear some clear-cut relation to the needs of the employer. There are many examples in Africa of polytechnics offering a technical education divorced from the real needs of the consumer. As mentioned earlier an academically over-qualified man can become a liability to his organization if his job and career prospects do not give him, in his view, adequate status—we are all aware of the " collar and tie " syndrome in Africa. The introduction of a modular form of academic education related to parallel job-training modules in a vocational training organization would be of inestimable benefit in our specialized technological fields.

Job-training itself can be sub-divided into three groups: working, supervisory, and management. There are of course many sub-divisions with different titles in each country, although a classification into about five kinds of job-level seems to have been generally accepted in both English and French-speaking Africa. Quantitatively speaking, the working group is the largest, and it is this group in particular which needs to be selected with the utmost care and oriented in the most positive fashion towards a long-term commitment to the technology concerned. When speaking of technology, I use the term in the broadest sense—our considerations apply equally to the telephonist, the technician and the book-keeper or clerk. Over the years the training methods relevant to this group have changed considerably, and in a sense the wheel has gone full circle, from on-the-job training with an experienced man to intensive school training, back to field training and now to a mixture of both. It is becoming more and more clear that the most economic way of training a man for a career at this level in telecommunications is by a system of training packages—commencing with say a six months period of basic training, followed by a specialized job-oriented course and then a spell in the field. Then back he comes for further specialized training followed by a spell in the field, and so on.

The importance of field work cannot be over-emphasized, because experience has shown that it is impossible to duplicate the working atmosphere of an operational organization in a school, however well equipped it may be. The organization of this system of " re-cycling " for in-service personnel is perhaps the most important aspect of a technological training programme and perhaps the most effective way in which a continuous check can be made of the output of a system and the efficiency of its working.

One of the problems of developing countries is to find the supervisors and managers necessary for a telecommunication business, since they do not have the long his-

tory of stable working conditions which normally permit almost automatic selection of future leaders. We therefore have to provide supervisory and managerial courses both for the talented workers from lower levels and for the graduate engineer who comes into the industry as a management trainee, highly qualified academically but with relatively little practical experience. The latter type of entrant into management presents special problems. The man who comes up through the ranks can be exposed to management techniques throughout his career, and the re-cycling mentioned above should be designed to cater for this. The new graduate entrant however tends to be over-confident in his ability to run things and is for this reason a dangerous man to let loose on a telecommunications organization before he has been properly indoctrinated and given some practical background experience of the work which he will have to manage. This is particularly important when it involves the operation of complex and delicate equipment costing many thousands of dollars—for obvious reasons! However, the provision of management courses is not the complete answer, and under African conditions there can be no rapid substitute for experience. Mention is made later of an ITU endeavour, by means of African regional seminars, to communicate management skills in telecommunication which cannot as yet be found in the written word.

5. International contributions to telecommunications training

One interesting thing about running a public telecommunications undertaking is that in general there are no trade secrets to guard and nothing to sell. Hence it is to the interest of all to co-operate in sharing experience for the general good. As far as Africa is concerned I think we must all recognize the immense contributions that have been made by the developed countries to the education and training of telecommunication personnel. Each year many hundreds of young Africans go abroad on fellowships to learn their trade in the more experienced telecommunication administrations and to attend courses at technical colleges and universities. The ITU's Member administrations supply telecommunications experts, under bilateral and multilateral arrangements, to act as teachers or managers in large training institutes and small national schools. Certain countries have organized seminars in such subjects as " Satellite communication " and " Long-distance automatic telephony " and sometimes pay all the expenses of participants from Africa. School buildings in some African countries have been paid for entirely by friendly governments as a token of their interest in technical education.

The International Telecommunication Union is the responsible United Nations agency for telecommunications, and its role in the training field is partly to act as a catalyst for others and partly to carry out its own projects as an executing agency of the United Nations Development Programme (UNDP). Our " catalytic " activity is largely devoted to stimulating and canalizing the training opportunities offered by more developed countries, and I would like here to pay a tribute to the unfailing co-operation offered by our Member administrations—not forgetting the help we have also received from Africa itself.

As far as the ITU's own training activities are concerned, we are primarily concerned with helping our African Member administrations to fill the " middle gap " which is symptomatic of the situation in developing countries. In African telecommunication administrations we can usually find a fair number of low-level workers, sometimes of many years' seniority, who have been trained in the old days " on the job " and are quite capable of putting in a subscriber's telephone or erecting a telephone pole. Equally, most African countries have at some time sent their brightest boys abroad to be trained as professional engineers. These, after several years, return home usually to take up managerial and administrative positions behind a desk. But in between these two extremes there is a chronic shortage of skilled technicians and supervisory grades to shoulder the day-to-day burdens of telecommunication operation, and it is this gap which must be filled. Indeed, with technological advance, the need for the lower grade of workman becomes progressively less, and the need for the skilled technician more urgent. This situation creates grave problems for telecommunications administrations, because the training of skilled technicians requires a heavy investment in teaching staff and training installations which cannot possibly be justified in economic terms when the overall training requirement is fairly small. The ITU has carried out surveys in one or two African countries which have shown that their medium-term call for skilled telephone technicians, for example, is about 10 per year. In these circumstances, it is uneconomic for the organizations concerned to endeavour to train their own skilled personnel. The answer which the ITU believes to be the right one in the circumstances is for co-operating governments to create sub-regional groupings able to provide the various levels of training required economically and efficiently, and without unnecessary duplication of costly equipment. At the same time, we believe that a national telecommunications training school is desirable for even the smallest administration, essentially to provide low-level technical training, but also to create a departure point and a fund of experience for the later development of training activities in the country. The ITU is actively progressing sub-regional training complexes based on this philosophy in both East and West Africa, and it is interesting to note that when current plans are implemented there will be only six independent African States which have so far not received direct assistance from the ITU in the creation of a national telecommunications training school.

There remain two particular aspects of training which are, qualitatively, by far the most important. The problems of integrating management trainees into an operational organization have been men-

tioned above, and in addition one must not overlook the fact that the more advanced aspects of telecommunication management are not as yet the subject of formal training courses in any educational establishment. The transfer of experience in these areas is occasionally attempted in the proceedings of learned societies but, more often, can only be undertaken in the inner strongholds of advanced telecommunications administrations and large commercial concerns. The chances of African managers to learn these skills are obviously limited.

The ITU is tackling this problem by the organization of high-level seminars on management techniques, both at our headquarters in Geneva and in Africa. I may add that participants in these seminars are made to work—we do not ask them to simply come and be talked at—and that the devising of practical exercises in the subject is a rewarding and fascinating pastime for our lecturers.

Finally, the training of teachers. This is a complex matter which is fraught with difficulties of both an academic and economic nature. It is very difficult to find the right material to train and even more difficult to keep the trained men on the job. Perhaps the only solution here is for governments to accept that the creation of a permanent cadre of professional teachers is vital to the success of any training programme and to submit to the necessity of offering the best men sufficient inducement to make teaching a career. Many African countries have in the past adopted a doctrine of interchangeability of operational and training personnel, a system that with proper precautions can work well in a stable industrial society. In African conditions, where the population is only just gaining experience of modern methods and organization, and where the technologically trained man is the exception rather than the rule, we will have to accept for some time to come a certain degree of inflexibility in career structures, and attempt to ensure by intensive training in instructional techniques that African teachers are able to master their jobs and devote a lifetime to their profession.

6. Work programme for the future

This paper has dealt with the general problems of technological training as we in the telecommunications field see them, and, with intent, has neglected those fascinating technical aspects of teaching as it may one day be applied in Africa. Here I have in mind modern developments such as programmed learning, teaching machines and so on, devices designed on the one hand to liberate the teacher from the routine chores of his profession, and on the other, to permit him to follow more closely the individual progress of his pupils. The ITU intends to investigate these aspects of training activity and for this purpose to draw upon the accumulated experience of sister organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations Institute for Training and Research (UNITAR).

It may be useful to recall here that to do a job well calls for two qualities—" ability " and " will ". It is the quality of the teacher to transfer to his pupils the skill and knowledge required, and to this extent the technical training function is a matter of efficient communications; an art as well as a technique; the fostering of " ability ". The other side of the coin—" will "— is conditioned by attitude, motivation and morale, and it is clearly the responsibility of governments to create the conditions in which these qualities in a pupil can be reinforced as part of the training function. Forward manpower planning, job analysis, the creation of an adequate career structure and the provision of opportunity for further academic and professional advancement are activities proper to national administrations, with the aid as necessary of bilateral and multinational technical co-operation programmes. Agencies such as the ITU, on the other hand, need to intensify their research into the methodology of technical training in their specialized fields and, in particular, need to define the international standard to which students should be trained to do a specific job. We have also found a wide divergence between the quality of training materials—books and equipment—taken into use by different training projects and, although realizing the profound influence of national conditions, feel that here is a field of study which might permit future rationalization and economy of means on an international basis.

Finally, a word should be said about the need for co-operation in the training field between the specialized technical agencies. The ITU has felt for some time that there is a considerable overlap between the various training programmes of the agencies and that some centralized co-ordination could be established both at national and regional level to prepare jointly sponsored projects in electronics and communications for, say, aviation, broadcasting and meteorology. There is not a great deal of difference in the basic subject matter to be taught and it seems that we are overlooking opportunities of real economy in this domain. Further, we have had the occasional experience of difficulties caused by insufficient preparation of projects, and particularly by the lack of a detailed in-depth analysis of technical manpower requirements leading to proper justification of our training proposals. It seems there may be a case for a co-ordinated approach to this problem at the national level, even if only on a once-for-all basis, so that we will all have before us a reference by which to co-operate with governments and each other in the development of technological skills, in the right amounts and at the right levels. The Economic Commission for Africa (ECA) has already adopted a resolution calling on the international agencies to draw up development programmes based on the assessed needs of African countries in critical areas of manpower and training, and it might be appropriate at this point in time to examine the ways and means in which this resolution could be put into effect.

(Original language: English)

THE JOURNAL

One hundred years ago

Reduced charges for non-urgent telegrams.

The statistical tables published by the Journal reveal that the increase in the number of telegrams resulting from reduced charges has led to an unwelcome rise in labour and material costs. It is well known that the tariffs applied in a number of countries have increased operating costs and, as things are, it is to be expected that the services will run at a loss for a long time to come.

. . . . .

This has set me wondering whether it might not be a good thing to introduce a category of low-rate telegrams *to be sent after the more important telegrams* on which the full rate has been paid.

It is true that people who send telegrams usually want them to arrive quickly; but there is no denying that nowadays telegrams are often sent because people do not want to take the trouble of writing a letter. These telegrams, concerned with ordinary day-to-day affairs, hold up the tranmission of more urgent correspondence.

If these lower-grade telegrams were kept off the line, or rather, if they were sent at times when they would not interfere with important messages, a greater volume of traffic could be handled without incurring the need for increased means of transmission.

. . . . .

* * *

News

The submarine cable laid by the China-Submarine Telegraph Company between Singapore and Cape St. Jacques in Cochin China was opened for traffic at the beginning of the month. Cape St. Jacques was already linked to various towns in the colony by a network installed and operated by dhe French Government, so that there are now direct telegraph communications with Saigon and other towns in Cochin China.

. . . . .

* * *

The overland and submarine cables now being installed by the Great Northern Telegraph Company to link Europe to China and Japan via Russia-in-Europe and Siberia will probably be opened to the public in the very near future.

. . . . .

* * *

Telegraph traffic in London. — In June 1870, there were 309 public telegraph offices in the London area. In June 1871, the number had risen to 439, or an increase of 42%.

During the week ending 18 June 1870, the number of telegrams sent by the 309 offices then open was 44 588. In the week ending 24 June 1871, the 439 offices in service sent 55 636 telegrams, or an increase of 25% over the year before. But the increase in local telegrams—i.e., from one London district to another—was much larger. During the week ending 18 June 1870, the number of telegrams was 5628; it rose to 9359 during the week ending 24 June 1871 an increase of 66%.

As the rate had not changed, the great increase in the number of local telegrams must doubtless be attributed to the increase in the number of public telegraph offices. There has been a steady and constant rise in the number of telegrams sent from one part of London to another. In June 1870, they represented 12% of the total number of telegrams sent from offices in London; in April 1871, they were 14% and in June 1871 nearly 17% of the total number.

(The Mechanics' Magazine).

Journal télégraphique — August 1871

ITU cinema library

Ref. IT-5

Pays — Country — País: ITALIE — ITALY — ITALIA

Titre — Title — Título: NOTIZIARIO PT N° 10 (Chronique PT n° 10 — PT Newsreel No. 10 — Noticiario CT N.° 10)

Format — Size — Tamaño: 16 mm

Poids — Weight — Peso:

Longueur — Length — Largo: 100 m

Durée — Duration — Duración: 8 min

Langue — Language — Idioma: italien — Italian — italiano

Observations — Remarks — Observaciones: noir et blanc, opt. — black-and-white, opt. — blanco y negro, electro-ópt.

Sujet — Subject — Asunto: Travail du Centre mécanographique de l'Administration de l'Etat pour les services téléphoniques (emploi de fiches perforées).

Work of the Mechanographical Centre of the State Telephone Administration (use of punched cards).

Trabajo del Centro mecanográfico de la Administración del Estado para los servicios telefónicos (empleo de fichas perforadas).

Editeur — Producer — Editor: Ministero delle Poste e Telecomunicazioni, Roma.

Date d'arrivée à l'UIT — Date of arrival at ITU — Fecha de recepción en la UIT: novembre 1968 — November 1968 — noviembre de 1968

Ref. TCH-2

Pays — Country — País: RÉPUBLIQUE SOCIALISTE TCHÉCOSLOVAQUE/1961 — CZECHOSLOVAK SOCIALIST REPUBLIC/1961 — REPÚBLICA SOCIALISTA CHECOESLOVACA/1961

Titre — Title — Título: MONTAZ KOAXIALNÍHO KABELU I (Installation des câbles coaxiaux — Installing coaxial cables — Instalación de cables coaxiles)

Format — Size — Tamaño: 16 mm

Poids — Weight — Peso:

Longueur — Length — Largo:

Durée — Duration — Duración: Part. I: 15 min
Part. II: 20 min

Langue — Language — Idioma: tchèque — Czech — checoeslovaco

Observations — Remarks — Observaciones: noir et blanc, opt. — black-and-white, opt. — blanco y negro, electro-ópt.

Sujet — Subject — Asunto: Nouveaux modes de pose et d'installation des câbles coaxiaux KMB-4.
A film on new methods of laying and installing KMB-4 coaxial cables.
Nuevas formas de tendido e instalación de cables coaxiles KMB-4.

Editeur — Producer — Editor: Administration des P&T de la République Socialiste Tchécoslovaque, Prague.

Date d'arrivée à l'UIT — Date of arrival at ITU — Fecha de recepción en la UIT: janvier 1969 — January 1969 — enero de 1969

note from the CCIR

basic indices for ionospheric propagation

THE FOLLOWING TABLES, giving values of the basic indices for ionospheric propagation, have been prepared by the Specialized Secretariat of the International Radio Consultative Committee (CCIR) in accordance with Resolution 4-1, Recommendation 371-1 and Report 246-2 of the XIIth CCIR Plenary Assembly (New Delhi, January-February 1970). In order to expedite the dissemination of the forecasts, the CCIR Secretariat prepares a monthly circular which is sent to administrations, about the 10th of each month, in conformity with the conditions given in circular-letter No. A.C./131 of 14 February 1969. Copies of these forecasts may be obtained, free of charge, from the Director of the CCIR, ITU, Place des Nations, 1211 Geneva 20, Switzerland.

Parameters:

R_{12} (smoothed mean, over twelve months, of the number of sunspots observed):

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1969	109	108	106	104	103	103	102	107	106	104	105	106
1970	106	107	107	107	106	105	103	100	95	92	87	82

I_{F_2} (ionospheric index) *:

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1970	111	112	124	129	144	125	122	117	133	119	130	111
1971	89	87	83	77	77	66						

* *For further details, see the* Telecommunication Journal, *April 1964, page 119, and January 1966, pages 43-47.*

Φ (monthly mean value of solar noise flux at 2800 MHz at 1700 h UT) **:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1970	159	175	158	162	168	155	152	138	143	150	162	153
1971	163	138	112	117	110	102						

** *Data kindly supplied by the National Research Council, Ottawa.*

Forecasts:

R_{12} ***

Year \ Month	7	8	9	10	11	12
1971	58	56	54	52	50	48

*** *Data kindly supplied by Professor Waldmeier, Federal Observatory, Zurich.*

Estimated error in forecasts of R_{12} six months in advance: ± 5.

Mean error on R_{12} predictions based on the 12 months preceding the month following that for which the last R_{12} value was calculated:

Prediction time (months)	0	1	2	3	4	5
Mean error	−6.1	−8.2	−10.2	−12.2	−13.8	−15.2
Standard deviation of the error	±7.4	±9.2	±9.8	±10.2	±10.0	±9.7

I_{F_2} ****

Year \ Month	6	7	8	9	10	11	12
1971	71	72	67	63	59	55	(53)

**** *Data kindly supplied by the Science Research Council, Radio and Space Research Station, Slough.*

The figure in brackets is the value forecast six months in advance.

Mean error in I_{F_2} predictions calculated over the 12 preceding months:

Period of prediction (months)	0	1	2	3	4	5	6
Mean error	3.4	1.5	0.0	−2.0	−4.5	−7,7	−10.8
Standard deviation of the error	±10.6	±14.8	±15.8	±16.8	±18.8	±19.5	±20.6

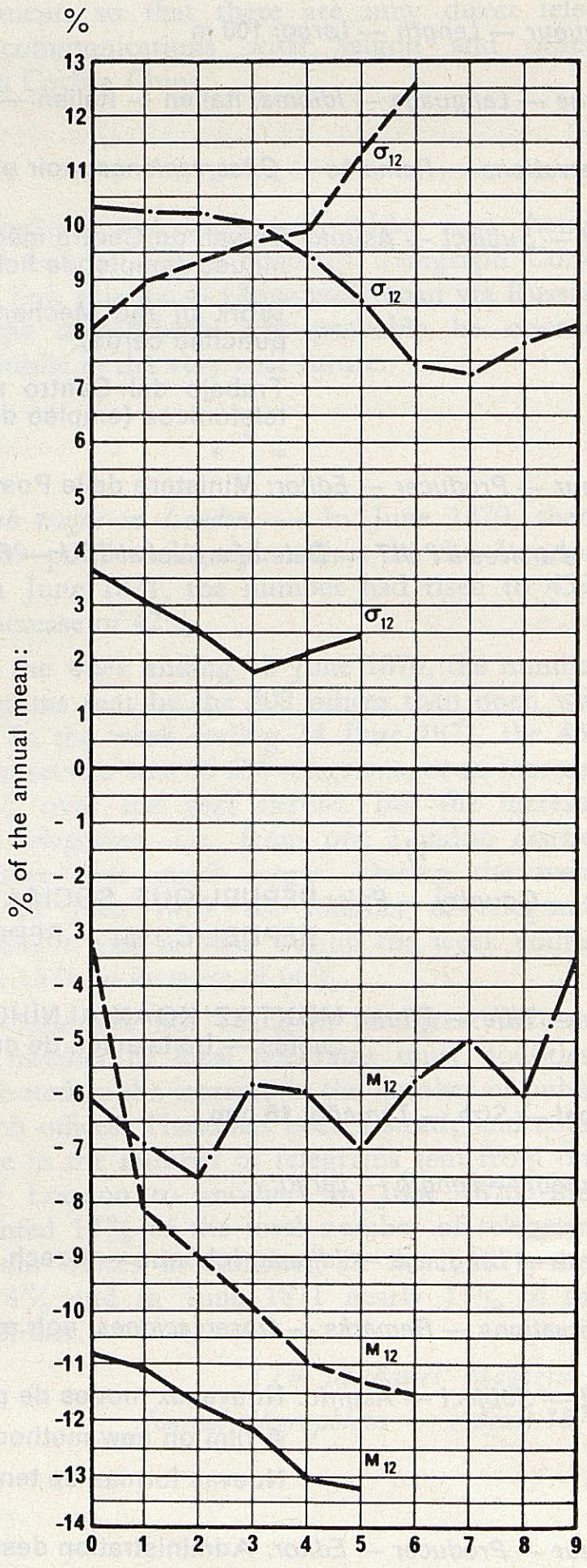
Φ *****

Year \ Month	7	8	9	10	11	12	1	2	3	4
1971	116	127	126	118	114	111				
1972							101	97	92	91

***** *Prediction by a method of extrapolation devised by the CCIR Secretariat, pursuant to Resolution 30 of the XIIth CCIR Plenary Assembly (New Delhi, 1970). (Use of the electronic computer in predicting basic indices for ionospheric propagation.)*

Mean error in Φ predictions calculated over the 12 preceding months:

Period of prediction (months)	0	1	2	3	4	5	6	7	8	9
Mean error	12.6	14.2	15.7	20.0	20.2	17.8	17.8	15.8	10.0	7.9
Standard deviation of the error	±13.6	±16.0	±16.7	±18.2	±19.6	±20.6	±20.7	±21.8	±22.4	±23.4



Analysis of R_{12}, I_{F_2} and Φ predictions in 1969
M_{12} mean error over 12 months
σ_{12} standard deviation of the error over 12 months

news

Centenary of the Australian overland telegraph line

☐ Commemorative ceremonies will be held in a number of places in Australia on 22 August 1972, to mark the centenary of the establishment of the famed overland telegraph line.

On that date 100 years earlier, the first telegram travelled over the line, from Darwin to Adelaide, marking a new era in communications in Australia. Several months later, the line was linked up with a cable system from the United Kingdom to Darwin, and gave Australia its first speedy communication with "the outside world". Prior to that, slow ship mail was the only link.

. . . installation of electronic telephone exchanges

☐ The Australian Post Office plans to install two electronic telephone exchanges in Melbourne and Adelaide in 1974 at a cost of 7.1 million Australian dollars. The equipment will be supplied by Standard Telephones and Cables Pty. Limited.

. . . 40 800 bits/s data transmission service

☐ The Australian Post Office put into operation its first 40 800 bits/s data transmission service between Melbourne and Sydney on 1 June.

The service, believed to be the first of its type to be installed in the Southern hemisphere, operates in each direction between computers in the Melbourne and North Sydney premises of Control Data Australia Pty. Limited.

Transmission of data at 40 800 bits/s was made possible by the use of a wide-band circuit equivalent to 12 individual trunk line telephone channels (48 kHz bandwidth), instead of a single channel.—*Australian Post Office.*

Direct telephone service opened between Tunisia and the United Kingdom

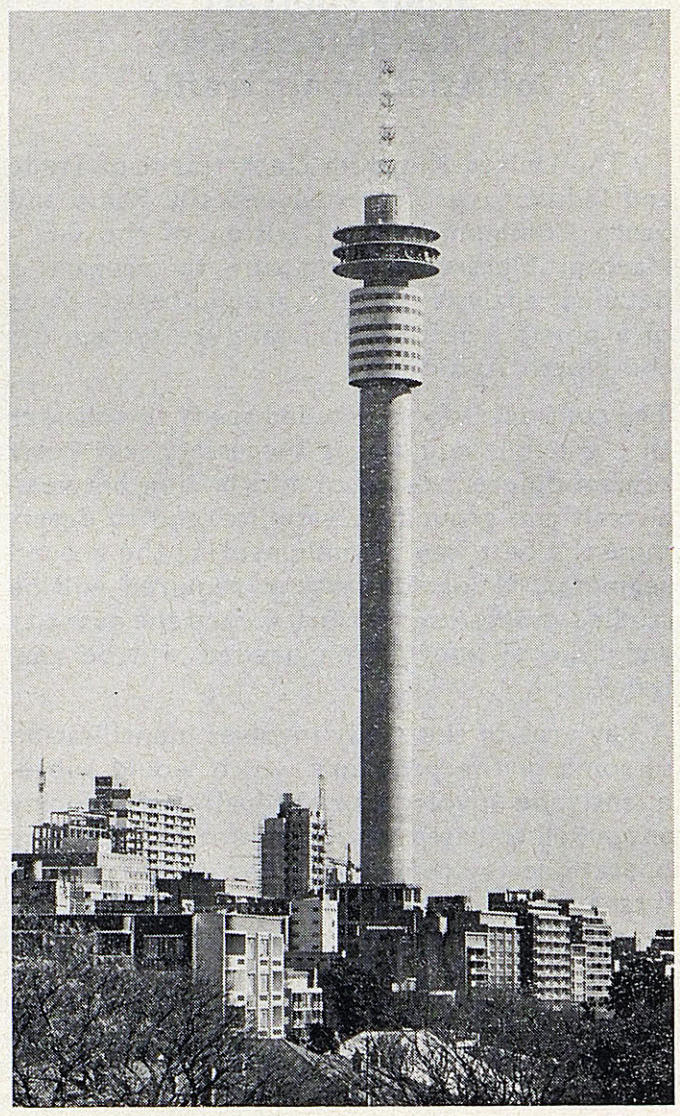
☐ Speedier connection of telephone calls between Tunisia and Britain is now possible with the opening of direct service between the two countries on 24 June 1971. Formerly calls had to go via an operator in Paris.

The service was inaugurated by M. Mohamed Masmoudi, Tunisian Minister for Foreign Affairs, who was visiting the United Kingdom at that time.

The service operates 24 hours a day. The charge for a call to Tunisia from Britain is 1.35 pound sterling for 3 minutes. — *United Kingdom Post Office.*

Microwave tower inaugurated in Johannesburg

☐ The J. G. Strijdom tower in Johannesburg was officially opened on 17 April 1971. It is the focal point of South Africa's microwave system. —*South African Administration.*



(South African Administration)

The J. G. Strijdom tower

Opening of the telex service France—Abu Dhabi and France—Montserrat

☐ On 15 June 1971 telex services were opened between France and Abu Dhabi (Arabian Gulf) and France and Montserrat (Caribbean).

The cost of communications is 49.98 French francs for the first 3 minutes (minimum charge) and 16.66 fr. for each extra minute.—*Ministère des P&T, France.*

Microwave link to control gas distribution network

☐ A turnkey contract worth a ¼ million pounds sterling has been placed by the British Gas Council with GEC-AEI Telecommunications Limited for the supply and installation of a microwave-radio link that will be used to control the North Sea gas high-pressure distribution pipeline.

The link will connect Gas Council headquarters in London with the pipeline control centre at Hinckley, with intermediate stations at North London, Kensworth, Charwelton, and an extension of the route to Leicester.

The link will be equipped with fully semiconductored microwave-radio equipment operating in the 7 GHz frequency band, and type *4M* carrier-multiplex equipment. Two bothway channels will be provided, one working and one standby, operating on a "hot standby" basis with automatic switching between them in the event of degradation of the signal. Each channel has an ultimate capacity of 240 circuits suitable for the transmission of speech, voice-frequency telegraphy, data, or telemetry controls.

A comprehensive time-division-multiplex supervisory system, which continuously monitors the link, has a capacity for displaying up to 32 indications showing fault locations both locally at each station and at the control terminal at Hinckley.—*GEC-AEI Telecommunications Ltd.*

War on coffee blight by radio

☐ In Kenya, radio programmes for the farming community have been giving training to coffee growers, who are mostly illiterate. Thanks to them, the damage that coffee blight can cause was effectively countered, thus avoiding heavy losses. A similar offensive is to be launched in Brazil, where the plantations are at present ravaged by the disease.

The Brazilian Coffee Institute is organizing a seminar in Campinas (State of São Paulo), from 29 June to 7 July, on the help to be derived from the radio programme for farmers in the fight against coffee blight.—*FAO.*

90 000 pounds sterling transmitter orders for extension of Irish language broadcasts

☐ *Radio Telefis Eireann* has placed two orders, worth nearly 90 000 pounds sterling with Marconi Communication Systems Limited, for a number of broadcast transmitters. Radio Telefis Eireann, which is the State Broadcasting Corporation of the Irish Republic, is to use the new transmitters to extend the coverage of *Radio na Gaeltachter*, their Irish language service.

Marconi will supply three 1 kW MF transmitters, two to be installed in parallel in County Galway, and one in County Kerry, with one 10 kWMF transmitter for installation in County Donegal. The second order is for three VHF FM 5kW transmitters including stereo drive. Both orders include all ancillary equipment.—*Marconi.*

News from INTELSAT . . .

. . . contract for advanced microwave filter

☐ A contract for the design and development of an advanced microwave filter has been awarded by the United States Communications Satellite Corporation (COMSAT) on behalf of the International Telecommunications Satellite Consortium (INTELSAT), to Westinghouse Electric Corporation, Baltimore, United States. Value of the contract is 20 500 US dollars.

. . . contract for digital speech interpolation equipment

☐ A contract worth 126 000 US dollars has been awarded by INTELSAT to *Società Italiana Telecomunicazioni Siemens s.p.a.* of Italy for the design and construction of digital speech interpolation equipment.—*COMSAT European Office, Geneva.*

Installation of earth stations . . .

. . . in New Zealand

☐ The satellite earth station at Warkworth, New Zealand, was officially opened on 17 July last by the Postmaster-General, Mr. Allan McCready.

Direct circuits have been opened to Australia, Hong Kong and the United States.—*Post Office News, New Zealand.*

Radar equipment . . .

. . . for Canada

☐ Eight of Canada's major civil airports are to have Marconi " bright " radar displays incorporated into their air traffic control systems. The order, worth over 100 000 pounds sterling, calls for the supply of 12 displays and 8 sets of back-up equipment with spare boards. The 12 displays will be installed singly or in pairs at the existing Montreal international airport, Toronto, Ottawa, Vancouver, the new Montreal St. Scholastique airport, Sault Ste. Marie, and the Training School at Carp.—*Marconi.*

. . . for Greece

☐ A 746 800 US dollars contract to supply three " Quadradar " air traffic control radar systems to Greece has been awarded to ITT Gilfillan, Incorporated, a subsidiary of the International Telephone and Telegraph Corporation (ITT).

The Quadradar is a complete terminal-area traffic-control radar system. It has terminal-area surveillance, precision-approach control, altitude determination, and airfield surface-surveillance capabilities.—*ITT.*

. . . for the United States

☐ The United States Federal Aviation Administration (FAA) has purchased an additional 29 semi-automated radar terminal systems (called *ARTS III*) from UNIVAC Federal Systems Division of the Sperry Rand Corporation for installation at medium activity airports around the United States.—*FAA.*

Study contract for satellite control of Atlantic air traffic

☐ The United Kingdom Department of Trade and Industry has commissioned the Radio and Space Communications Division of the GEC-Marconi Electronics Company to prepare a detailed analysis of the ground-based parts of a possible aeronautical satellite system for the North Atlantic.

The contract is for a detailed study to consider the ground equipment necessary to relay several different types of information between aircraft and ground via satellite, and to determine the best way of implementing the ground segments. Major sub-systems required will be studied, traffic flows estimated, and the quantity and type of information needed will be analyzed.

A key area of the study involves identification of some of the problems which would subsequently be involved in gradually introducing any satellite-based facilities into the existing operational system. Also, any areas needing further study or development will be pinpointed. — *Marconi Communication Systems Ltd.*

Personnel changes . . .

. . . in the Republic of Botswana

☐ Mr. W. E. Cromarty has been appointed Director of Posts and Telecommunications.

. . . in Japan

☐ Mr. Yoshimaru Kanno has been elected President of the Kokusai Denshin Denwa Company Limited (KDD) succeeding the late Mr. Tsutomu Utsubo.

. . . in the Republic of Singapore

☐ Mr. Goh Seng Kim has been appointed Director of Telecommunications.

technical news

International videovoice system

☐ A new system announced by RCA Global Communications, Incorporated, will permit businessmen in the United States and overseas points to exchange virtually instantaneous views of products, charts or other subjects as they talk. Called *Videovoice*, the system transmits still black-and-white television pictures over the same circuit used for a voice conversation. The photograph illustrates how a diagram under discussion could be transmitted via Videovoice.—*RCA.*

(RCA)

"Telextra" : an answer to the busy signal

☐ A new computerized international telex service improvement called *Telextra* is being introduced by RCA Global Communications, Incorporated, as an answer to the busy signal.

For subscribers sending an overseas telex call who cannot establish a connection, Telextra offers the option of transmitting the call to RCA Globcom's computer switching system at no extra charge. Telextra then automatically transmits the call when the overseas subscriber teleprinter is not occupied or a circuit becomes available.—*RCA.*

New tropospheric scatter equipment

☐ Marconi Communication Systems Limited has announced a new series of communications equipment which will significantly increase its total capability in tropospheric scatter systems.

The new range of equipment, modular in conception, is solid-state and fully compatible with other Marconi tropospheric scatter equipment. The low-level broadband terminal, type *H3102* series, operates at fixed frequencies in the 775 MHz to 985 MHz band. It is designed to transmit and receive up to 132 speech channels to CCIR specification. It will provide single-hop links of between 100 km and 750 km.

The 1 kW TWT amplifier is required to boost the transmitted signal from the low-level terminal to a power adequate to transmit it over the required distance. It requires a minimum of tuning, making it suitable for unattended working, and its broad bandwidth makes it ideal for two carrier operation.

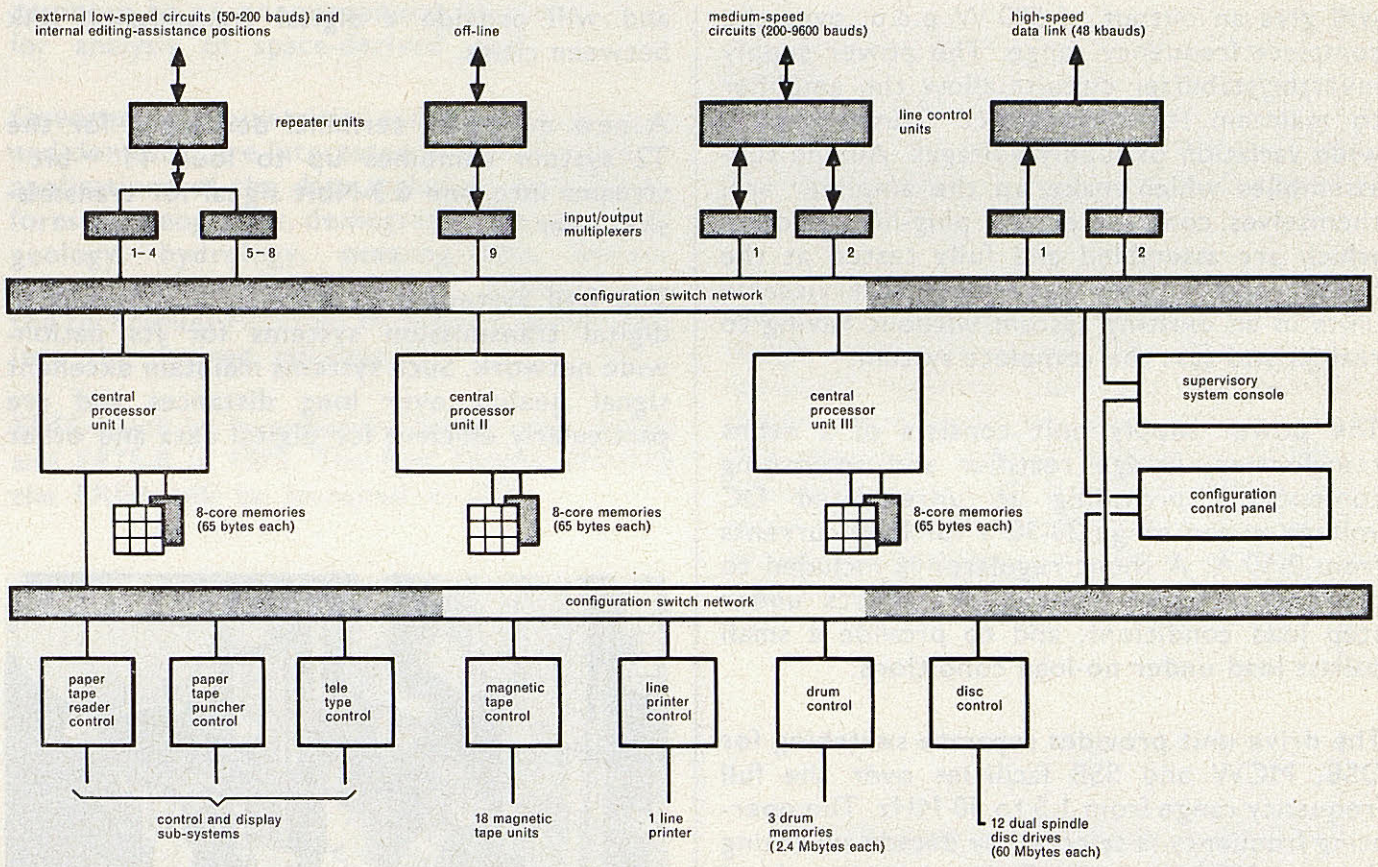
The equipment was on show at the ITU Telecom 71 exhibition in Geneva.—*Marconi.*

Stored programme retransmission system will speed international telegrams

☐ The United Kingdom Post Office has placed an order with PYE TMC Limited for the supply and installation of an electronic computer-based stored programme system to provide a faster and more efficient service for international telegrams.

Costing about 3¼ million pounds sterling, the system will be designed and manufactured in conjunction with *Philips Telecommunicatie Industrie.*

It will replace existing electro-mechanical and punched-tape installations.



DS 714 *configuration for the British Post Office* (BPO)

When it comes into operation in 1973 the system will be the largest and most comprehensive of its kind in the world, bringing greater speed and efficiency to the receipt and despatch of the 21 million international telegrams handled in Britain each year.

Initially it will be capable of receiving and forwarding 100 000 telegrams a day over the 500 lines to be connected to the system.

The new system, known as *DS 714*, will be introduced in stages. The first stage will provide automatic switching of telegrams—retransmitting telegrams collected at international area offices throughout the country to destinations abroad, and forwarding incoming overseas telegrams to addresses in Britain or to other countries overseas.

It will also be programmed for rapid retrieval of telegrams from a magnetic tape store to help deal with any enquiries, and for automatic extraction of information for accounting and invoicing customers.

In later stages the system will be programmed to identify automatically names of towns and cities and registered telegraphic addresses to cut transmission time. It will also be able to convert addresses in telegrams to telex numbers for immediate retransmission over the telex network. (Nearly half the overseas telegrams received for delivery in the United Kingdom are for customers who are telex subscribers and at present these are sent on by telex operators.)

The system will have three central processors. One will handle the full traffic flow, one will be on standby, and the third will be used for operational control and programme development.—*United Kingdom Post Office/ PYE TMC Ltd.*

All solid-state high-power transmitter

☐ An entirely new, high-power, solid-state communication transmitter for fixed and transportable roles has been developed by Marconi Communication Systems Limited. The transmitter is completely solid-state, including the final output stages, and will deliver up to 1 kW in the HF band from 1.5 MHz to 30 MHz, with a setting accuracy of 1 Hz.

This new transmitter, designated the *H1080*, is designed for any role where communications must be maintained with absolute reliability under the most arduous conditions to be encountered anywhere in the world.

The transmitter comprises two 500 W amplifier modules each with an independent power supply, and a drive unit. An external antenna tuning unit is required in this configuration. A hybrid combiner in the output stage adds the outputs of the two amplifier modules, and will continue to provide an output of reduced power, should one of the amplifier modules become unserviceable.

The 500 W amplifier module is made up of two 250 W amplifier stages, a pre-amplifier, protection systems and stabilized power supplies. An input level of 100 mW maximum

will give an output of 500 W p.e.p. over the complete frequency range. The power supply inverter/stabilizer circuits allow the amplifier to maintain its performance figures over a wide variation of supply voltages. All the sub-assemblies which make up the amplifier are, themselves, constructed as " plug-in " modules which are assembled and fully tested at the factory, so that they can replace unserviceable units in an existing system without having to realign and test the complete system.

The power supply unit consists of a mains transformer, bridge rectifier and smoothing components providing an unregulated DC voltage in the range 20-30 V for load currents from 0-50 A. A shunt regulator is included to prevent transient voltage overshoots under step load conditions, and to provide a small ballast load under no-load conditions.

The drive unit provides separate switching for DSB, MCW and SSB facilities over the full frequency range from 1.5 to 30 MHz. The operating frequency is selected by decade switching down to 100 kHz, with a fine tuning control and digital frequency selection down to 1 Hz.—*Marconi.*

New " T2 " digital transmission system

☐ A new digital transmission system is being developed at Bell Telephone Laboratories (BTL) as a high-capacity communications link between cities. The new system, known as *T2*, is designed to provide service economically over distances up to about 800 km.

Scheduled for commercial service in 1972, the T2 system is able to carry more than 4400 simultaneous telephone conversations over two 50-pair cables.

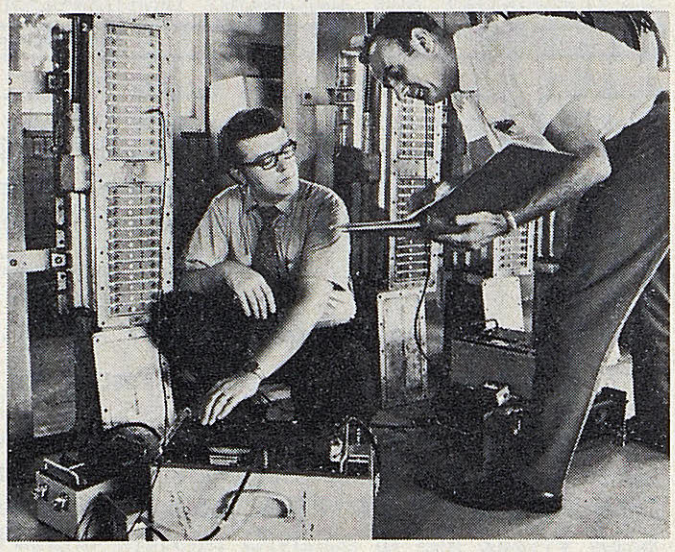
The new system transmits over cables containing twisted pairs of wires and provides capacity for 96 voice channels or one Picturephone ® signal for each wire-pair. In the Pennsylvania field trial 50-pair cables are being used, producing a route capacity of 4400 conversations. In commercial operation, cables larger than 50-pair cables are also expected to be used.

In addition to voice telephone traffic, the T2 system will transmit data, facsimile and, in the future, Picturephone® service, carrying information in digital form at a rate of 6.3 million bits/s. The error rate of the T2 system will be less than one incorrect bit in a billion for the average 800 km T2 line.

T1, the Bell System's first digital system, was introduced in 1962 and has a digital rate of 1.5 million bits/s. Since 1962, nearly one million T1 voice channels have gone into operation, primarily in and around major cities. The T2 system has four times the capacity of T1 and will provide a digital transmission link between cities.

A new multiplex terminal developed for the T2 system combines up to four T1 " bit " streams into one 6.3-Mbit signal for transmission over T2.

The Bell System is developing a hierarchy of digital transmission systems for its nation-wide network. Such systems maintain excellent signal quality over long distances and are particularly efficient for digital data and other non-voice signals. Use of these digital systems combined with analog systems on the growing Bell System network will offer substantial economies handling the rapidly increasing volume of communications. — *BTL.*



(BTL)
A final check—Engineers check the transmission specifications on apparatus cases before activating the field trial of the new T2 *digital transmission system. The new system, which carries information at a digital rate of 6.3 Mbits/s, is expected to go into commercial service during 1972*

New development to streamline telephone switchboard operation

☐ The United Kingdom Post Office is to develop an entirely new type of operator switchboard to serve telephone exchanges through the last quarter of this century.

Based on solid-state electronics and using stored programme control, the switchboard system is designed to reduce operating time for a call; and it will enable switchboards to be placed many kilometres away from the exchange control equipment in areas where staff can be recruited most readily.

A contract worth about 750 000 pounds sterling has been placed by the Post Office with Marconi Communication Systems Limited to develop the system to Post Office specification and to provide two prototype switchboards with their associated control equipment. Following successful completion of stringent laboratory tests, the Post Office will place an order for 50 switchboards for a pilot exchange installation.

Large-scale orders for the new switchboard to be used in national and international exchanges could stem from experience gained with this pilot exchange.

At the switchboard operators will push buttons to connect calls. Information required for billing will be recorded automatically and full details of the call will appear on a video display unit to aid the operator.

To ensure that telephonists will work with minimum fatigue the switchboard and key layout have been designed in conjunction with the Post Office Human Factors Research Laboratory and with specialist assistance in the fields of ergonomics and applied psychology from the Medical Research Council.—*United Kingdom Post Office.*

(BPO)
Model of the new telephone exchange switchboard

" Esro-II " (Iris) re-enters the atmosphere

☐ After orbiting the earth for nearly three years, and having travelled about 400 million kilometres, *Esro-II* (*Iris*) re-entered the atmosphere on 8 May shortly after 03.00 hours GMT after completing 16 282 orbits.

Iris, the first of the four satellites developed and placed in orbit by the European Space Research Organisation (ESRO) was launched on 17 May from the Western Test Range, California (see *Telecommunication Journal*, July 1968, page 310). Its mission was to study solar electromagnetic and corpuscular radiation.—*ESRO.*

" Mariner-9 " performing well

☐ Its flight path slightly adjusted by a mid-course manœuvre on 4 June, *Mariner-9* has settled down for a 161-day journey to Mars.

At a distance from earth of 1 350 000 km, Mariner was turned in space to aim its 1334 Newton thrust rocket engine for a precise 5.11 s burn. The resulting velocity change was 6731 m/s.

On its original course from launch at Cape Kennedy, Florida on 30 May, Mariner would have flown past Mars approximately 25 000 km from the surface. It was deliberately aimed at this point to ensure that it would not impact Mars and contaminate the planet with micro-organisms from earth prior to a life search on Mars planned for the unmanned *Viking* missions in 1976.

This first mid-course manœuvre was planned to place Mariner-9 in a new flight path that would skim past Mars at approximately 1600 km from the surface. A second mid-course manœuvre is planned about 24 October 1971, if necessary to further correct the trajectory. Finally a 14 min burn of the onboard rocket engine on 13 November will insert the spacecraft into an orbit about Mars with a low point of 1200 km and a high point of 16 000 km.

Mariner-9 is planned to return scientific data on the atmosphere and surface and 5000 to 6000 photographs for at least 90 days while orbiting Mars.—*NASA.*

Requests for data from " ERTS " satellites

☐ The United States National Aeronautics and Space Administration (NASA) has received more than 600 proposals from potential domestic and international users of data expected to be obtained from the Earth Resources Technology Satellites (*ERTS*) and the Earth Resources Experiment Package (*EREP*) to be carried on *Skylab*.

This is the greatest number of proposals for experiments ever received by NASA in response to an announcement of opportunity for analysis of space-derived data.

Government, universities and industry, foreign and domestic, are interested in a wide range of applications of the data including agriculture, forestry, geography, demography, cartography, geology, hydrology, oceanography, meteorology, environmental quality, ecology, and the techniques required to convert sensor data into the desired information.

ERTS-A will be launched by NASA next spring and *ERTS-B* in 1973. The first Skylab carrying the EREP will be launched in 1973.

. . . Canadian-United States agreement on use of " ERTS " satellites

☐ Canada and the United States have agreed to a joint programme for use of satellites and aircraft in surveys of the natural environment. The satellites will be launched by the United States National Aeronautics and Space Administration (NASA).

Objective of the programme is the advancement of remote sensing technology for the monitoring of air, water, land, forest and crop conditions, and the mapping of ice movements and ocean currents in Canadian and American waters. Mapping of geologic, hydrologic, vegetation and soil phenomena will also be carried out.

Under the agreement, the Canadian Department of Energy, Mines and Resources (EMR) will receive data directly from NASA's Earth Resources Technology Satellites (*ERTS*) scheduled for launching in 1972 and 1973. The Canadian ground readout station will be located in Prince Albert, Saskatchewan, and the data handling facility in Ottawa, Ontario.—*NASA.*

Tracking and data relay satellite system

☐ The United States National Aeronautics and Space Administration (NASA) held a pre-proposal conference in June for a study of a Tracking and Data Relay Satellite System (TDRSS). Purpose of the study is to provide NASA with design and cost information on tracking and data relay satellites and the interfacing elements of an overall system.

NASA engineers believe current technology in communications satellites has evolved to a point where it is practical to consider usinga TDRS system as an integral part of the tracking and data acquisition networks.

Under provisions of the request for proposals, respondents are to consider the overall TDRS system to include two geosynchronous satellites positioned approximately 130° apart, both being viewable from a common point in the United States. The spacecraft may use either spin or three-axis stabilization.

The study is to be conducted in two phases. The initial study phase will provide preliminary design and cost factors for the satellites, spacecraft tracking, telemetry and command system, telecommunications service system and associated ground station to service a reference set of user spacecraft. Part II of the study is to detail necessary changes required to provide increased telecommunications service to higher data rate users. — *NASA.*

Preliminary definition studies of the "GEOS" satellite

☐ The European Space Research Organisation (ESRO) has just selected two European industrial consortia to carry out competitive definition studies on its geostationary scientific satellite project *GEOS*. The mission of GEOS will be to study the particle flux in the magnetosphere and relationships between the magnetosphere and the ionosphere.

ESRO had invited tenders from various firms in the ten Member countries of the Organization.

The tenders selected were those submitted by the *Mesh* and *Star* consortia.

The Mesh Consortium is composed of the following firms:

Erno	Fed. Rep. of Germany (main contractor)
Matra	France
Saab	Sweden
HSD	United Kingdom
Fiat	Italy

with whom are associated:

AEG/Telefunken	Fed. Rep. of Germany
Alcatel	France (for the GEOS project)

The Star Consortium is composed of the following firms:

BAC	United Kingdom (main contractor)
Contraves	Switzerland
Dornier GmbH	Fed. Rep. of Germany
LM Ericsson	Sweden
CGE, Fiar	Italy
Fokker	Netherlands
Montedel	Italy
Sabca	Belgium
Thomson-CSF	France

For the moment, only the first phase of the definition studies has been approved, with an expenditure ceiling of 250 000 AU being set for each consortium. The main aim of this first phase is to conduct, in close collaboration with the scientists responsible for the experiments, a critical examination of the satellite with the object of introducing simplifications that would reduce its cost. This phase should take approximately three months. At the end of it, the organization will decide whether to embark on the definition studies proper; if it is decided to proceed, the work will be continued by the same consortia.—*ESRO.*

United States—USSR space negotiations

□ Space negotiations between United States and Soviet agencies on compatible docking systems resumed 21 June at the Manned Spacecraft Center, Houston. Three joint working groups met to work out a single set of technical requirements for the systems.

Some 20 Soviet space scientists and engineers, including a cosmonaut, attended the meetings called for under the agreement reached in Moscow on 28 October 1970.

The agreement provides for three working groups:

- *Working Group 1* is to assure the compatibility of overall methods and means for rendezvous and docking.
- *Working Group 2* is to ensure compatibility of radio guidance systems, optical and other guidance systems and communications.
- *Working Group 3* is to assure compatibility of docking assembly and tunnel. — *NASA.*

UTILIZATION OF INTELSAT TELECOMMUNICATION SATELLITES

MARCH 1971

region	general telecommunications	television service	
	number of telephony circuits leased on full-time basis at end of month (see note *a*))	number of transmissions	transmit time (see note *b*))
Atlantic	1326	82	36 h 31 min
Pacific	652	32	9 h 07 min
Indian	191	6	7 h 40 min

APRIL 1971

region	general telecommunications	television service	
	number of telephony circuits leased on full-time basis at end of month (see note *a*))	number of transmissions	transmit time (see note *b*))
Atlantic	1352	95	37 h 29 min
Pacific	669	38	16 h 57 min
Indian	211	1	0 h 06 min

Notes:

a) Includes leased telex and data circuits expressed in terms of telephony-circuit equivalent. Excludes circuits leased under special contracts for use by NASA for the *Apollo* programme. Also excludes circuits used on an occasional basis for cable restoral and for peak demands. INTELSAT's revenues from leased circuits as shown in the table represent the great bulk of INTELSAT's total receipts from operations.

b) Represents the combined total of all periods of transmission. Receive time is somewhat higher because of some multi-destination transmissions. INTELSAT's total revenues from television service normally represent considerably less than 5% of INTELSAT's total receipts from operations.

Source: COMSAT European Office.

SATELLITE LAUNCHINGS NOTIFIED DURING PERIOD 22 MAY TO 15 JUNE 1971

Code name Spacecraft description	International number	Country Organization Site of launching	Date	Perigee* Apogee	Period* Inclination	Frequencies Transmitter power	Observations
Cosmos-423 weight: 408 kg; diameter: 1.20 m; length: 1.80 m	1971-47-A	USSR (Plesetsk)	27 May	282 km 511 km	92.2 min 71°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radiotelemetry system. Military electronics monitor
Cosmos-424	1971-48-A	USSR (Plesetsk)	28 May	214 km 309 km	89.4 min 65.4°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radiotelemetry system. Reconnaissance surveillance mission
Mars-3 weight: 4650 kg	1971-49-A	USSR (Baikonur)	28 May	heliocentric orbit			Automatic interplanetary station. Main objectives are investigations of Mars and interplanetary space
Cosmos-425	1971-50-A	USSR (Plesetsk)	29 May	511 km 556 km	95.2 min 74°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radiotelemetry system. Multimission monitor
Mariner-9 weight: 448 kg (without propellants); octagonal structure 1.27 m across the flats; 2.29 m high; 4 solar panels and Ni-Cd battery	1971-51-A	United States NASA (Cape Kennedy)	30 May			2296.11 MHz 10 or 20 W (tracking signals and data)	*Mariner-9* combines the original mission objectives of both *Mariner-8* (which failed) and *Mariner-9*. Objectives are to map 70% of the Martian surface and to observe temporal changes over small regions. Data on the atmospheric composition, density, pressure and temperature and the surface composition, temperature and topography of Mars will be collected. *Mariner* is due to arrive at Mars on 14 November 1971 and orbit Mars for a minimum of 90 days
Cosmos-426	1971-52-A	USSR	4 June	394 km 2012 km	109.3 min 74°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radiotelemetry system
Soyuz-11	1971-53-A	USSR (Baikonur)	6 June	185 km 217 km	88.3 min 51.6°		Three-man spacecraft: commander Dobrovolsky; flight engineer Volkov; research engineer Patsaev. *Soyuz-11* was docked with *Salyut* on 7 June 1971 and Patsaev and Volkov occupy *Salyut* to check systems and conduct biological experiments on the effect of weightlessness. The two spacecraft were separated, after the return of the crew to *Soyuz-11*, on 29 June. On 30 June 1971 the crew all died during re-entry
No name	1971-54	United States	11 June				

Code name Spacecraft description	International number	Country Organization Site of launching	Date	Perigee * Apogee	Period * Inclination	Frequencies Transmitter power	Observations
Cosmos-427	1971-55-A	USSR	11 June	211 km 337 km	89.7 min 72.9°		Carries scientific apparatus, radio system for precise measurements of orbital elements, and radiotelemetry system
SAMOS weight: 6800 kg	1971-56	United States (Vandenberg AFB)	15 June	181 km 299 km	89.3 min 96.4°		Reconnaissance surveillance satellite

* Initial orbital data

Sources: COSPAR, NASA, Specialized Press

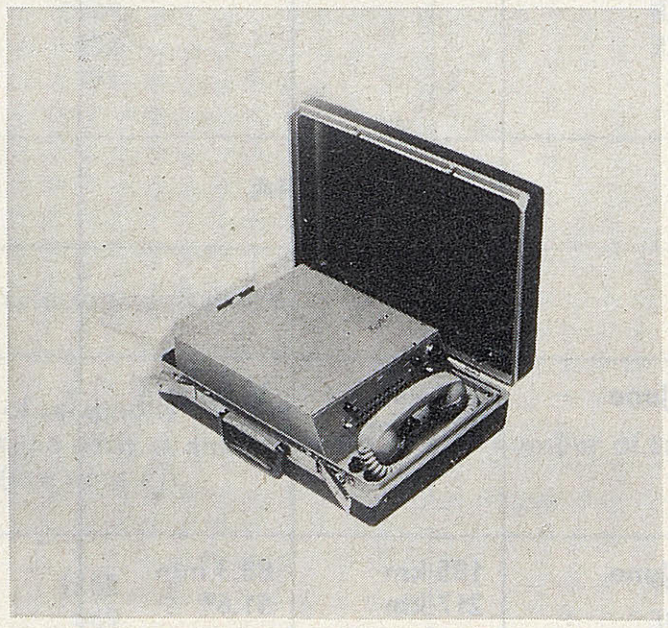
new products

Portable speech scrambler for telephone or VHF radio communication

☐ Lynch Communication Systems announces the availability of their new *E75*, issue *3* speech scrambler for use on land or sea or in the air with operation from either telephone or radio communication circuits.

Complete privacy of voice conversation transmitted over telephone circuits or radio is assured by the selection of any one of 1408 different code cards. The illegal tapping of telephone circuits or monitoring of radio transmissions will be heard only as garbled, unintelligible speech to anyone other than the person who possesses the matching code card and identical equipment.

The power source can be any 117 V outlet (230 V optionally) or a 12 V DC source such as an automobile cigarette lighter receptacle.



(Lynch Communication Systems)
Portable speech scrambler

The compact E75 is enclosed in a standard, durable attaché case. — *Lynch Communication Systems.*

(Lynch Communication Systems, 695 Bryant Street, San Francisco, California 94107, United States)

Detector for radio interference

☐ A portable transistorized VHF interference and noice measuring set, the Eddystone type *31A*, is a new weapon in the fight for cleaner and clearer reception in the crowded VHF television, radio broadcast and communications wavebands. The receiver has been engineered by Eddystone Radio Limited, from a design by the United Kingdom Post Office, to detect and home-in on interference sources so that action can be taken to suppress the nuisance. Eddystone Radio is a division of Marconi Communication Systems, part of GEC-Marconi Electronics Limited.

After securing the development contract for 100 receivers, Eddystone Radio now have Post Office authority to market the equipment on a world-wide basis. Operating in the VHF bands from 31 MHz to 250 MHz (bands I, II and III), the characteristics of the receiver are tailored to international standards on radio frequency noise and field strength measuring equipment.

The type 31A may be regarded as a calibrated RF amplifier or as a selective voltmeter. The gain can be standardized at any tuned frequency so that circuit noise at the frequency produces a reference deflection on the output meter. When a signal at the tuned frequency is then applied to the input, and the attenuators adjusted to restore the output indication to the reference deflection level, the level of the signal relative to one microvolt is given by the sum of the attenuator readings and a correction factor appropriate to the individual receiver. In conjunction with the telescopic antennae supplied, the receiver may be used to measure field strength, or to trace signals to their source by direction-finding or intensity comparison techniques. — *Eddystone Radio Ltd.*

(Eddystone Radio Limited, Marconi House, Chelmsford CM1 1 PL, United Kingdom)

review of reviews

A list of articles in other technical publications which may be of interest to readers of the Journal. The articles are listed under the language of the publication.

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books

PULSE AND SWITCHING CIRCUITS [1]

by Harvey F. Swearer.

[1] *One bound volume; pp. 256; illustrations, diagrams. 22×14 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1970. Price: 7.95 US dollars.*

Written mainly for those involved in the practical everyday applications of pulsing and switching, this 256-page book is not an engineering thesis. It is a practical examination of pulses, the circuits that shape them, and the variety of ways they can be put to work.

The volume begins with an examination of pulses, basic definitions, and pu e parameters. It then studies pulse generators and circuit response characteristics. The remainder of the book is devoted to a variety of practical applications: remote control, television, computers, radar, telemetry, etc.

A. El-Zanati

COMPUTER CIRCUITS AND HOW THEY WORK [2]

by Byron Wels.

[2] *One bound volume; pp. 192; illustrations, tables, diagrams. 22×14 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1970. Price: 7.95 US dollars.*

This 192-page volume is intended to explain the inner workings of modern computers. The author breaks the field of computer technology into specific smaller areas. Using a simplified language, he explains how the various points of a computer work and the technology associated with each part and function.

The book is divided into four sections, a glossary and an appendix. The first section begins with a dicussion of how computers work, including the " language " of computers, then proceeds to explain the principles of the central processor, the memory, control section, registers, etc. The second section deals with comparators, error detection, and parity checking. Section 3 provides a comprehensive treatment of memories—the types used and how they function. Section 4 is devoted entirely to circuits and applications, actual circuits designed to perform a wide variety of functions.

A. El-Zanati

INTERNATIONAL BROADCASTING CONVENTION — 7-11 SEPTEMBER 1970 [3]

(Institution of Electrical Engineers (IEE) Conference Publication No. *69*)

[3] *One volume paperback; pp. 295, illustrations, photos, diagrams. 30 × 21 cm. Published by the* Institution of Electrical Engineers, *Savoy Place, London WC2, 1970. Price: 7.50 pounds sterling.*

This volume contains the proceedings of the 1970 " IEE International Broadcasting Convention ", which was held in London and sponsored by the Electronic Engineering Association, the Institution of Electrical Engineers (IEE), the Institute of Electrical and Electronics Engineers (IEEE), the Institution of Electronics and Radio Engineers (IERE), the Royal Television Society and the Society of Motion Picture and Television Engineers.

The 81 papers presented at the Convention contain a wealth of information on the current state of all phases of broadcast engineering, and should be of interest to broadcast engineers and technicians.

Contents include: automation of engineering operations in television transmission; new techniques in television standards conversion; PAL decoders for broadcast use; coverage planning for VHF local radio; some aspects of the digital control of studio cameras; tolerances for PAL; the use of common aerials for UHF transmissions; operational techniques in the transmission of colour news film, etc.

A. El-Zanati

MEHRFACHREGELUNGEN GRUNDLAGEN EINER SYSTEMTHEORIE (ZWEITER BAND) [4]

(Multiple control technique: basic principles of systems theory, Vol. *II*), by Helmut Schwarz.

[4] *One bound volume; pp. 456, tables, diagrams. 26 × 18 cm. Published by* Springer-Verlag, *Heidelberger Platz 3, 1 Berlin 33, 1971. Price: 34.10 dollars.*

Volume *II* of *Mehrfachregelungen* is a continuation of the material set forth in the first volume. It deals with analysis and synthesis procedures for multiple-controlled systems. It covers not only continuous systems, but the essential laws of time-discrete systems. The two volumes together give a complete survey of the more important results of the theory of linear polynomial systems, including an account of the most recent developments.

The volume is divided into four chapters covering the principles of the presentation of phase space; linear vector spaces and matrix functions; special problems of analysis and synthesis of polynomial control systems; and optimum control systems.

It is aimed both at the practical control technician and at undergraduate students of control technique. Research workers should also find the comprehensive presentation of a mass of individual results of considerale help in their work.

A. El-Zanati

TRANSMISSION OF SYNCHRONOUS DIGITAL SIGNALS [5]

by D. van der Houwen.

[5] *One volume paperback; pp. 95; tables, diagrams. 24×17 cm. Published by* Staatsbedrijf der Posterijen, Telegrafie en Telefonie, *The Hague, 1971. Price: 35 florins.*

The material presented in this 95-page volume is the result of investigations made by the author in the field of digital transmission, and is meant as a systematic exposition of the principles of synchronous digital transmission. This study is primarily intended to provide the fundamentals for the design of low-pass pulse transmission systems.

Chapter I contains a general consideration of the transmission problem. The transmitted signal and the transmission channel are defined, and several detection or quality criteria are proposed. The second chapter deals with the problem of detecting a synchronous digital signal in the presence of noise. In Chapter III the joint optimization of transmitter and receiver is discussed. Chapter IV deals with multi-level transmission. Finally, the book concludes with a chapter discussing the so-called memory detector.

Transmission of Synchronous Digital Signals is certainly an invaluable addition to the literature on the subject.

A. El Zanati

ELECTRON OPTICS [6]

3rd edition, by O. Klemperer and M. E. Barnett.

[6] *One volume; pp. 506, illustrations, tables, diagrams. 22 × 15 cm. Published by* Cambridge University Press, *Bentley House, 200 Euston Road, London NW1. Price: 9 pounds sterling.*

This book is concerned primarily with the experimental aspects of electron optics. It introduces the student to a specialized topic, and summarizes the basic principles and the essential data for the research worker or designer of electron optical gear.

This third edition has been completely updated, and nearly half of the contents of the previous edition have been rewritten. Some sections on new branches which have recently become important in electron optics have also been added (e.g., methods of trajectory tracing of digital computer and the optics of quadrupole lenses). Practical applications of electron optics have been used to illustrate the principles under discussion.

Electron Optics will be of interest to the advanced undergraduate student of general physics and to the research worker who has not specialized in either geometrical optics or electron physics.

A. El-Zanati

ARCHIVES U.I.T. GENEVE

INTELSAT/IEE INTERNATIONAL CONFERENCE ON DIGITAL SATELLITE COMMUNICATION — 25-27 NOVEMBER 1969 [7]

(Institution of Electrical Engineers (IEE) Conference Publication No. *59*)

[7] *One volume paperback; pp. 558, illustrations, tables, diagrams. 30 × 21 cm. Published by the* Institution of Electrical Engineers, *Savoy Place, London WC2, 1969. Price: 11.45 pounds sterling.*

The 558-page volume contains papers presented at the International Telecommunications Satellite Consortium (INTELSAT)/IEE International Conference on digital satellite communication which was held between 25 and 27 November 1969 at the Institution of Electrical Engineers, London. The 46 papers read at the Conference cover almost every aspect of the new developments in the field of digital satellite communications.

The contents cover: possible solutions for a synchronous network; traffic problems in a telephone network via satellite with preassigned and demand assigned circuits; the telecommunication satellite as an integrated time division transmission-switching system; economic aspects of data transmission by satellite; a survey of interference problems associated with the use of digital satellite communications; etc.

A. El-Zanati

INTERNATIONAL SYMPOSIUM ON MANAGEMENT AND ECONOMICS IN THE ELECTRONICS INDUSTRY—17-20 MARCH 1970 [8]

(Institute of Electrical Engineers (IEE) Conference Publication No. *62*)

[8] *Two volumes paperback; pp. 445; suppl. pp. 197; illustrations, tables, diagrams. 30 × 21 cm. Published by the* Institution of Electrical Engineers, *Savoy Place, London WC2, 1970. Price: 12 pounds sterling.*

All aspects of management and economics in the electronics industry were reviewed in detail at an international symposium held at the University of Edinburgh between 17 and 20 March 1970. The symposium, organized by the Institution of Electrical Engineers (IEE), was held in association with the Institution of Electronics and Radio Engineers (IERE), the Institute of Physics and the Physical Society, and the Institute of Mathematics and its Applications, with the support of 14 other professional societies in the United Kingdom. The 95 papers presented at the symposium have been reproduced in two volumes from the author's manuscripts, and should be of great help in the study of the latest developments in the management techniques and the economics of the electronics industry.

A. El-Zanati

FREE AND FAIR: COURTROOM ACCESS AND THE FAIRNESS DOCTRINE [9]

edited by John M. Kittross and Kenneth Harwood.

[9] *One volume paperback; pp. vi, 202; tables. 22 × 15 cm. Published by the* Association for Professional Broadcasting Education, *Journal of Broadcasting Publications, Temple University, Philadelphia, Pennsylvania 19122, 1970. Price: 3.95 US dollars.*

This volume was edited for those who need a handy inexpensive collection of readings on two of the more serious and more interesting problems facing American broadcasting. These problems are the right to broadcast from the courtroom, and the question of ensuring fairness in the broadcasting of matters of public controversy. These readings—the first in the series "Readings from the *Journal of Broadcasting*"—sample only two of the important issues that have appeared in the pages of that Journal during the past 13 years. They should open a way to the study of pertinent statutes, orders, decisions and other precedents without requiring the reader to have had previous intensive study of law.

This 202-page volume will be of great help to the broadcaster and the teacher of broadcasting who need a guide to the various points of dispute. It will also be used as a most helpful source of supplemental readings for university-level students of broadcasting and of journalistic law and regulation.

A. El-Zanati

UNDERSTANDING SOLID-STATE CIRCUITS [10]

by Norman H. Crowhurst.

[10] *One bound volume; pp. 189; tables, diagrams. 22 × 14 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1970. Price: 7.95 US dollars.*

This volume provides the basic information necessary to understand solid-state circuits with all the pertinent details explained in factual language.

The first chapter of *Understanding Solid-State Circuits* deals with diodes, transistors, and their operating modes, FETs, light sensitive devices, etc. The information presented in the second chapter on linear amplification is thorough: it covers DC and AC feedback, current gain, phase inversion, etc. Chapter 3 offers a discussion on power amplification using single and push-pull stages, complementary symmetry, and protection circuits, while chapter 4 presents a most complete treatment of feedback and its applications. Chapters 5 and 6 explain sinusoidal oscillators and function generator circuits, respectively. The last three chapters are devoted to a discussion of gain-controlled amplification, control and logic integrated circuits.

A. El-Zanati

CONFERENCE ON RELIABILITY IN ELECTRONICS — 10-12 DECEMBER 1969 [11]

(Institution of Electrical Engineers (IEE) Conference Publication No. *60*)

[11] *One volume paperback; pp. 188; illustrations, tables, diagrams. 30 × 21 cm. Published by the* Institution of Electrical Engineers, *Savoy Place, London WC2, 1969.*

Organized by the Institution of Electrical Engineers (IEE) in association with the Institution of Electronics and Radio Engineers (IERE), the Institute of Electrical and Electronics Engineers (IEEE), the Institute of Physics and the Royal Society, the " Conference on reliability in electronics " was held in London between 10 and 12 December 1969. The 30 papers read at the Conference are reproduced in this 187-page volume. The topics discussed are varied in scope and length (e.g. quality management in the 1970's; the value of reliability prediction; satellite reliability engineering; reliability of marine radar; reliability aspects of the *Esro-II* satellite programme).

The significance of the Conference is in the fact that by treating the problems of reliability in electronics, specialists engaged in the field have the possibility to exchange experience and report the latest developments in the field.

A. El-Zanati

tenders

We should be obliged if any administrations wishing to make use of this column would send us their tenders if possible two months before the closing date for bids.

ALGERIAN DEMOCRATIC AND POPULAR REPUBLIC

The Ministry of Posts and Telecommunications of the Algerian Democratic and Popular Republic invites tenders for the installation of the link Ouargla—Relizane.

Specifications for the tender can be consulted at or obtained from the " Ministère des PTT, Sous-direction du matériel et des marchés, 4, boulevard Salah Bouakouir, Alger ", on payment of 100 dinars.

The closing date for the submission of tenders shall be at 12 noon on 18 September 1971.

Bidders shall be considered to be committed by their offers for 90 days from the closing date for sending bids to the above address.

REPUBLIC OF THE NIGER

With a view to supplementing and improving its telecommunication equipment, the Ministry of Posts and Telecommunications of the Republic of the Niger, in collaboration with the African Development Bank, invites a series of international tenders for the supply of the equipment required to install and put into service the following communication links:

- single-channel radio-relay link Niamey—Ouallam
- 24-channel radio-relay link Niamey—Dosso
- 12-channel open-wire line carrier link Niamey—Maradi
- 12-channel open-wire line carrier link Maradi—Zinder
- one 2-wire open-wire line circuit Niamey—Filingue
- one 2-wire open-wire line circuit Tahoua—Keita
- multiple duct underground conduits and telephone cables.

The specifications and invitations to tender may be obtained either from the Ministry of Posts and Telecommunications in Niamey or from the delegation of the Niger to the Common Market in Brussels.

official announcements

INTERNATIONAL TELECOMMUNICATION CONVENTION, MONTREUX, 1965

The **Republic of Cyprus** has ratified the International Telecommunication Convention, Montreux, 1965.

The instrument of ratification was deposited with the General Secretariat of the Union on 9 June 1971.

OPTIONAL ADDITIONAL PROTOCOL TO THE INTERNATIONAL TELECOMMUNICATION CONVENTION, MONTREUX, 1965, ON THE COMPULSORY SETTLEMENT OF DISPUTES

The **Republic of Cyprus** has ratified the Optional Additional Protocol to the International Telecommunication Convention, Montreux, 1965, on the Compulsory Settlement of Disputes.

The instrument of ratification was deposited with the General Secretariat of the Union on 9 June 1971.

VACANCY NOTICES

A circular-letter which has been sent to all Members of the Union announces the following vacancies:

- two posts of male or female **operators (Laboratory), grade G.5,** in the Specialized Secretariat of the CCITT; temporary appointment for one year (possibility of extension to cover a maximum period of three years); entry on duty: 1 January 1972. (Circular-letter No. 258 of 5 July 1971; vacancy notice No. 6-1971 ITU; final date for submission of applications: 4 October 1971).

Only applications forwarded through administrations can be taken into account; detailed applications with personal histories should be submitted to the General Secretariat of the ITU, Place des Nations, 1211 Geneva 20 (Switzerland), not later than the final date mentioned above.

TECHNICAL CO-OPERATION

Recruitment of experts

Circular-letters, which have been sent to all Members of the Union, announce the following field vacancies:

● one post of **telecommunications switching instructor** at the National Telecommunication Training Centre (Ankara) of the Directorate-General of Posts, Telegraphs and Telephones of Turkey. This post is to be filled as from October 1971 for 18 months. (Circular-letter No. 254 of 23 June 1971; field vacancy notice TC 49/71 TUR-518/SF; final date for submission of applications: 1 September 1971);

● one post of **expert in radio frequency management and monitoring,** for four months. This post is to be filled as soon as possible for the Posts and Telecommunications Department of Ceylon. The duty station will be Colombo. Visits to the radio receiving station at Pothody, approximately 35 km from Colombo, will be necessary. (Circular-letter No. 255 of 24 June 1971; field vacancy notice TC 50/71 CEY-510/TA; final date for submission of applications: 2 September 1971);

● one post of **technical instructor (transmission),** for one year with possibility of extension. This post is to be filled as from January 1972 for the Ministry of Posts and Telecommunications of the Republic of the Niger. The duty station will be Niamey. (Circular-letter No. 256 of 29 June 1971; field vacancy notice TC 51/71 NER-504/TA; final date for submission of applications: 7 September 1971);

● two posts, namely: one of **instructor in radiocommunications (LF/MF/HF)** and one of **instructor in telegraphy** at the Telecommunication Training Institute (Tehran) of the Ministry of Posts, Telegraphs and Telephones of Iran. These two posts are to be filled as from October 1971 for two years with possibility of extension to three years. (Circular-letter No. 257 of 30 June 1971; field vacancy notices TC 52/71 IRA-521/SF and TC 53/71 IRA-522/SF; final date for submission of applications: 8 September 1971).

Only applications forwarded through administrations can be taken into account; detailed applications with personal histories should be submitted to the General Secretariat of the ITU, Place des Nations, 1211 Geneva 20 (Switzerland), not later than the final dates mentioned above.

CALENDAR OF ITU CONFERENCES AND MEETINGS

DATE	TITLE	PLACE
1971		
	International Telegraph and Telephone Consultative Committee (CCITT):	
1-10 September	GAS 3 (Economic and technical comparison of transmission systems)	Geneva
13-17 September	GAS 5 (Economic conditions and telecommunication development)	Geneva
23-27 September	Working Party RTG (Working Party to revise the Telegraph Regulations)	Geneva
27 September-1 October	Working Party IV/3 (Routine maintenance programme)	Geneva
28 September-1 October	Study Group I (Telegraph operation and tariffs—including the telex service)	Geneva
4-6 October	Working Party XIII/2 (Traffic engineering)	Geneva
4-8 October	Working Party IV/5 (Maintenance instructions for new systems)	Geneva
11-22 October	World Plan Committee	Venice
8-12 November	Sub-Working Group NRD 1/2 (Interworking between synchronous data networks)	Geneva
8-12 November	Study Group II/4 (Sound programme and television transmissions)	Geneva
8-17 November	Various Working Parties of Special Study Group D (Pulse code modulation)	Geneva
15-19 November	Modems Working Party of Special Study Group A (Data transmission)	Geneva
22-24 November	Maintenance Working Party of Special Study Group A (Data transmission)	Geneva
22-26 November	Working Party TER (Earthing systems)	Geneva
22-26 November	Study Group XII (Telephone transmission performance and local telephone networks)	Geneva
29 November-3 December	Study Group XVI (Telephone circuits)	Geneva
6-10 December	Team of experts for organization and methods of work of the CCITT	Geneva
	Joint Study Group of the two CCIs: World Plan Committee (see under CCITT)	
1972		
27 May-16 June	**27th Session of the Administrative Council**	**Geneva**

INVITATIONS ACCEPTED TO CONFERENCES OR MEETINGS EXTERNAL TO THE UNION

DATE	ORGANIZATION	NATURE OF CONFERENCE OR MEETING	PLACE	REPRESENTATIVES
1971				
6-16 September	United Nations (UN)	4th International Conference on the Peaceful Uses of Atomic Energy	Geneva	Mr. R. E. BUTLER *(Deputy Secretary-General)* Mr. H. POULIQUEN Mr. R. SMITH Mr. A. EL-ZANATI *(General Secretariat)*
13-17 September	Inter-Governmental Maritime Consultative Organization (IMCO)	24th Session of the Maritime Safety Committee	London	Mr. R. PETIT *(IFRB)*
13-22 October	Economic Commission for Africa (ECA)	7th Session of the Conference of African Statisticians	Dakar	Mr. R. MÉTAYER *(ITU Regional Expert)*

ITU publications

The following letters indicate the languages in which documents are published

F *for French*
E *for English*
S *for Spanish*
R *for Russian*
C *for Chinese*

Prices are in Swiss francs.

Note

A comprehensive list of all the publications of the Union will be supplied free on request by the General Secretariat, Geneva.

Publications issued since the last number of the Journal

List of fixed stations operating international circuits, 6th edition, 1 February 1971

Trilingual edition **F, E, S.**

Price: 57 Sw.fr.

List of broadcasting stations operating in bands below 5950 kc/s, 6th edition, 1 February 1971

Trilingual edition **F, E, S.**

Price: 33 Sw.fr.

List of stations in the space service and in the radio astronomy service, 3rd edition, 1 May 1971

Trilingual edition **F, E, S.**

Price: 60 Sw. fr.

List of telegraph offices, 23rd edition, 1 January 1971

Trilingual edition **F, E, S.**

Price: 56 Sw. fr.

List of point-to-point radiotelegraph channels, 1970 edition

Trilingual edition **F, E, S.**

Price: 12 Sw. fr.

IFRB

International Frequency Registration Board

Summary of monitoring information received by the IFRB for the period from 27 December 1970 to 1 May 1971

No. **169**

Trilingual edition **F, E, S.**

High frequency broadcasting schedule—November schedule 1969—D (1969)

Period: 2 November 1969 (0100 TMG)
1 March 1970 (0100 TMG)

Trilingual edition **F, E, S.**

Tentative high frequency broadcasting schedule—September schedule 1971

Period: 5 September 1971 (0100 TMG)
7 November 1971 (0100 TMG)

Trilingual edition **F, E, S.**

CCIR

International Radio Consultative Committee

XIIth Plenary Assembly of the CCIR (New Delhi, 1970)

Volume II—Part 1—Propagation in non-ionized media (Study Group 5)

Volume II—Part 2—Ionospheric propagation (Study Group 6)

Separate editions in **F, E, S.**

Price (Part 1): 30 Sw.fr. (F, E)
32 Sw.fr. (S)

Price (Part 2): 32 Sw.fr. (F, E)
30 Sw.fr. (S)

Price of Volume II complete: 62 Sw.fr. (F, E, S)

Volume IV—Part 1—Fixed service using radio-relay systems (Study Group 9)— Coordination and frequency sharing between communication-satellite systems and terrestrial radio-relay systems (subjects common to Study Groups 4 and 9)

Volume IV—Part 2—Fixed service using communication satellites (Study Group 4) — Space research and radioastronomy (Study Group 2)

Separate editions in **F, E, S.**

Price (Part 1): 42 Sw.fr.
Price (Part 2): 54 Sw.fr.
Price of Volume IV complete: 96 Sw.fr.

Volume VI — Mobile services (Study Group 8)

Separate editions in **F, E, S.**

Price: 44 Sw.fr.

Forthcoming publications

List of international monitoring stations (List VIII), 3rd edition
Trilingual edition **F, E, S.**

List of international telephone routes, 11th edition, 1971
Trilingual edition **F, E, S.**

International frequency list, 6th edition, 1971
Multilingual edition in **F, E, S, R, C.**

List of radiodetermination and special service stations (List VI), 5th edition, 1971
Trilingual edition **F, E, S.**

Summary of monitoring information received by the IFRB
No. 170 (May-July 1971)
Trilingual edition **F, E, S.**

High frequency broadcasting schedules
(4 publications per annum)
Trilingual edition **F, E, S.**

Seminar of recent progress in telecommunication techniques/Integration of satellite communications into the general telecommunications network
Separate editions in **F, E, S.**

Table B—Telegraph rates of the extra-European system, 4th edition, 13 October 1971
Trilingual edition **F, E, S.**

CCIR
International Radio Consultative Committee

Supplement No. 1 to Report 340 "CCIR atlas of ionospheric characteristics"—Report 340-1
Trilingual edition **F, E, S.**

CCITT
International Telegraph and Telephone Consultative Committee

Economic and technical aspects of the choice of transmission systems, 1st edition, 1969
Spanish edition.

Plan Book for Africa, Lagos, 1971
Trilingual edition **F, E, S.**

"Propagation" Appendix to the GAS/3 handbook
Separate editions in **F, E, S.**

CONDITIONS OF SALE

All documents ordered from the General Secretariat of the ITU must be paid for in advance. Documents must be paid for in Swiss francs when they are ordered, unless a cash-on-delivery arrangement is requested.

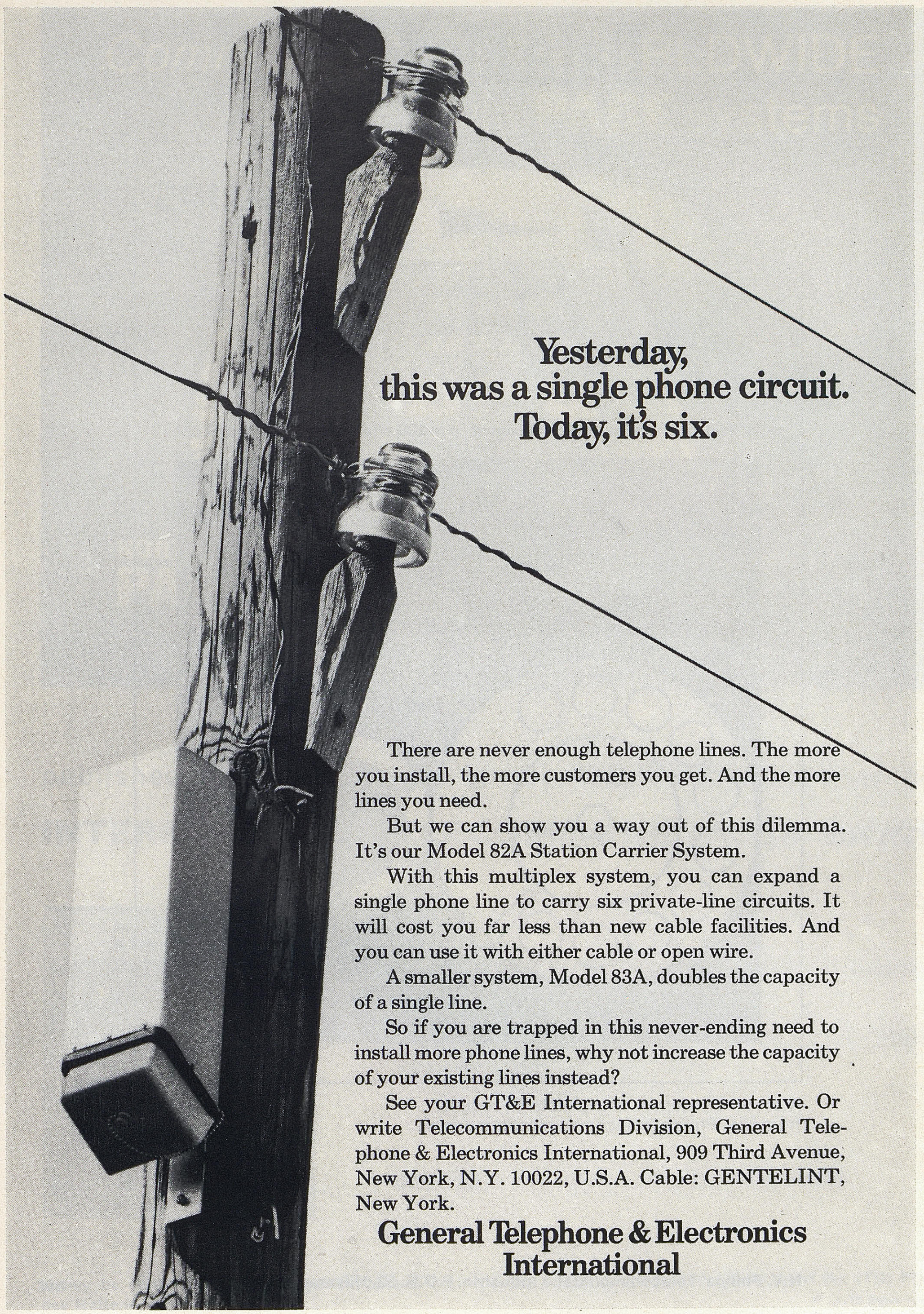
Methods of payment:

1. **Switzerland:** to the postal cheque account of the ITU, GENÈVE 12-50
2. **All other countries:**
   a) international postal order,
   b) UNESCO coupon,
   c) bank transfer to the Société de Banque Suisse, Geneva.

(Payment may also be effected by a cheque made out in another currency freely convertible into Swiss francs provided that the cheque, when cashed and converted, will cover the price of the publication in Swiss francs.)

Orders for documents, and cheques must be addressed to:
International Telecommunication Union, Place des Nations, 1211 Geneva 20, Switzerland.

The prices quoted include packing costs and carriage by surface mail.



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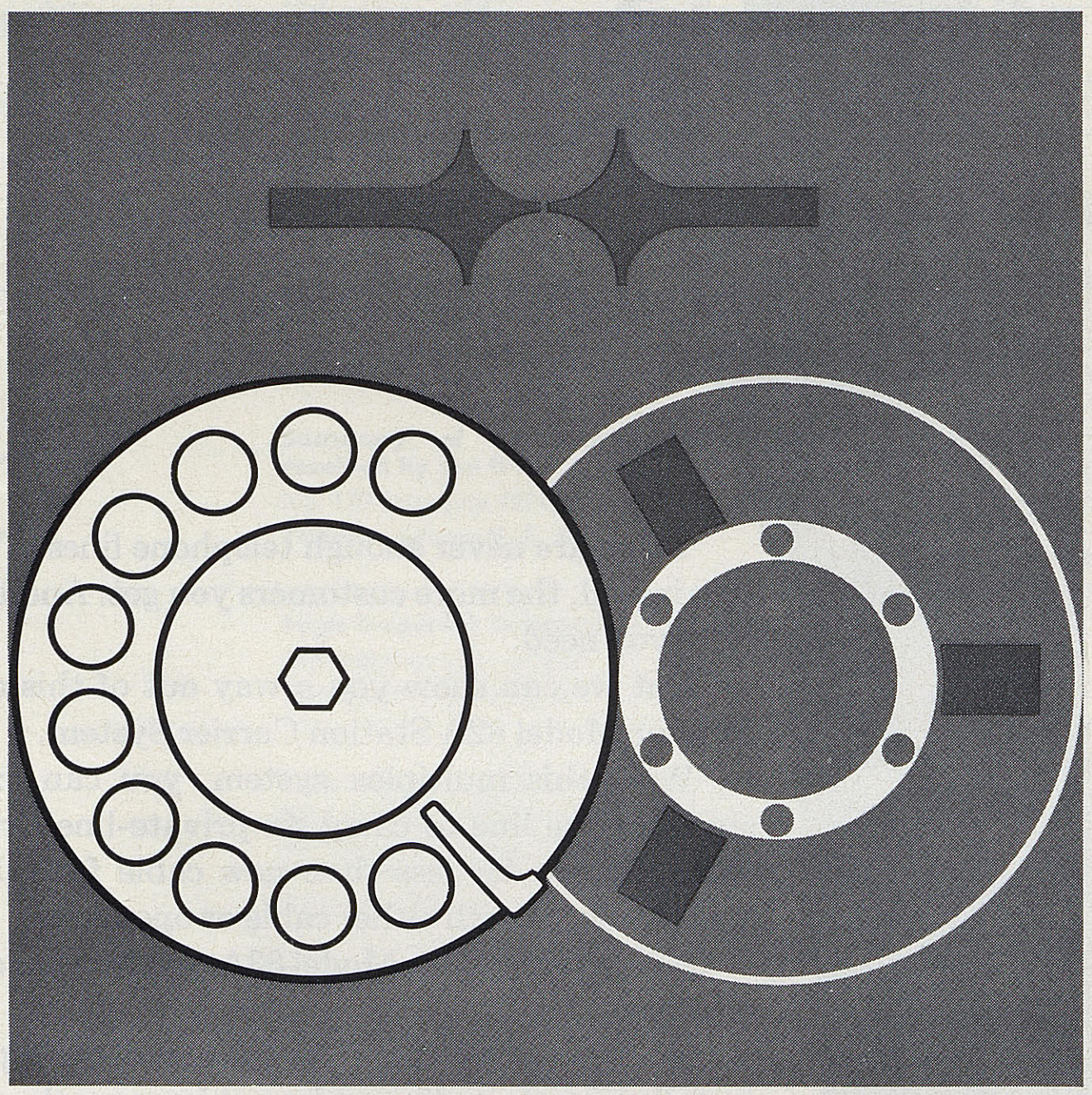

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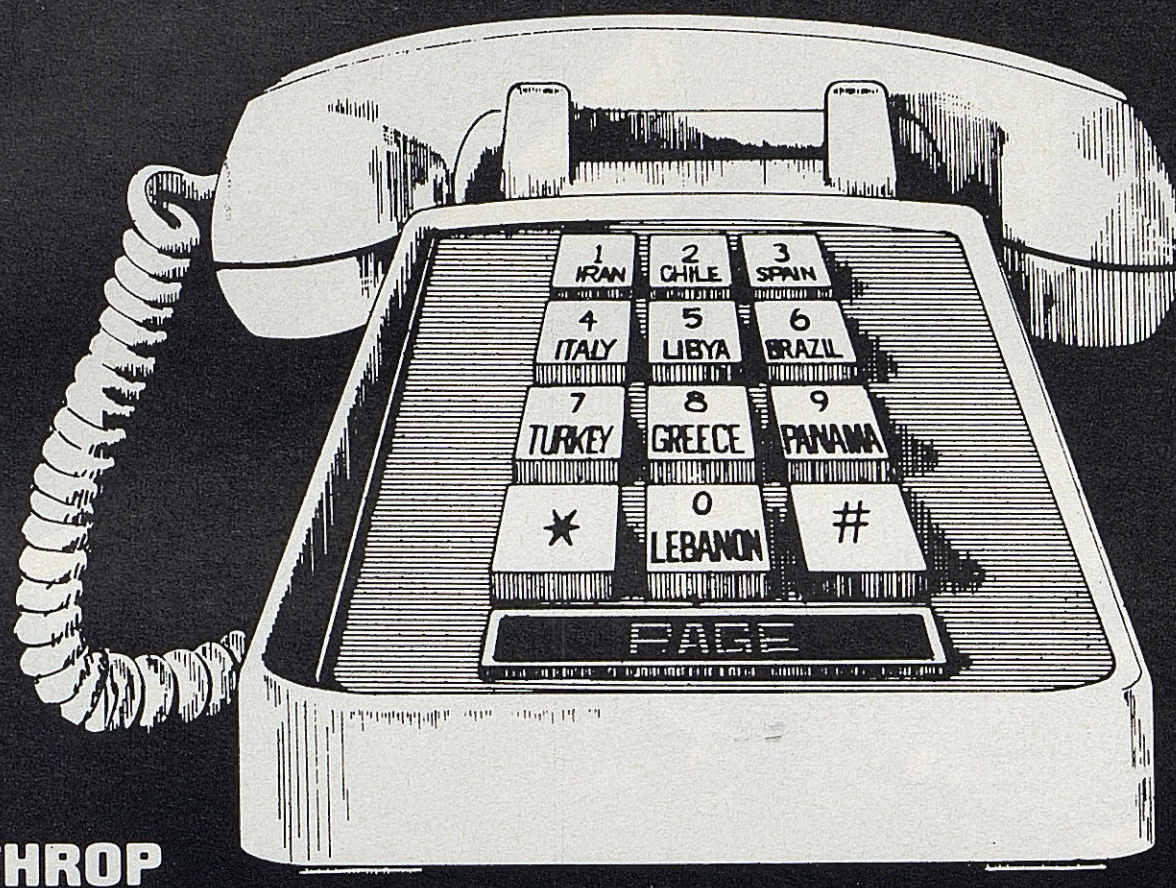

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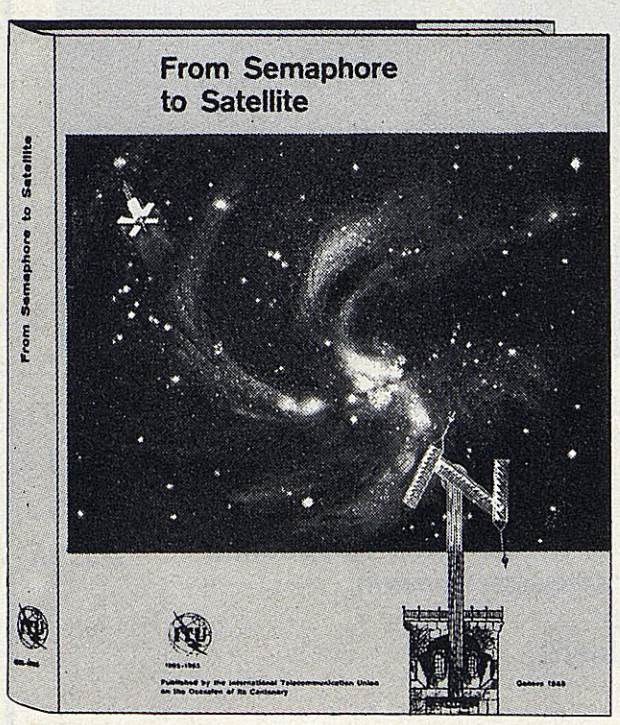

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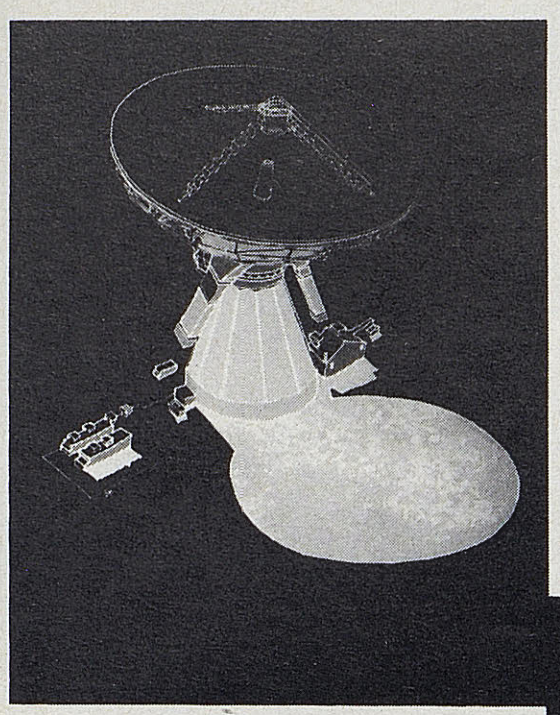

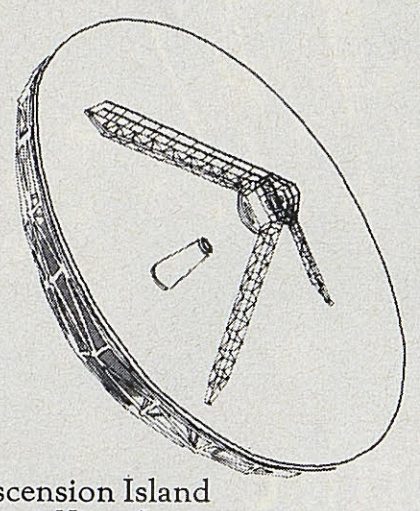

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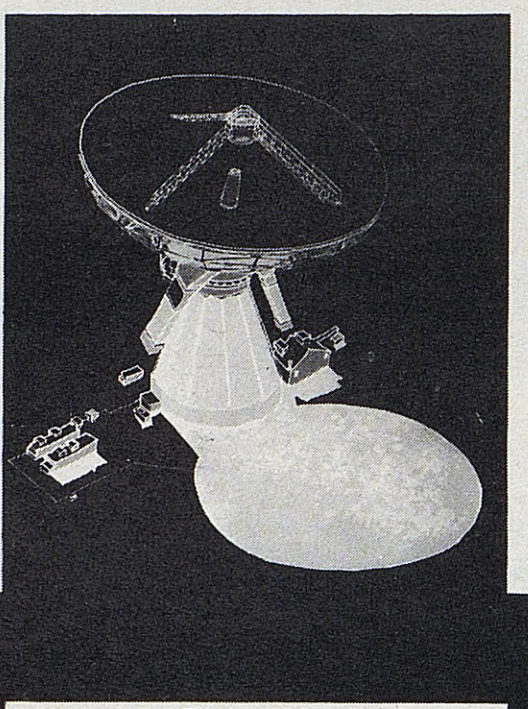

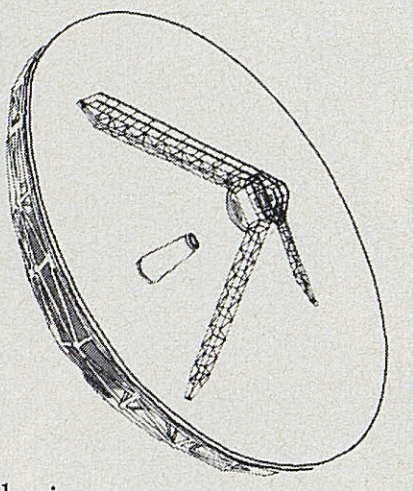

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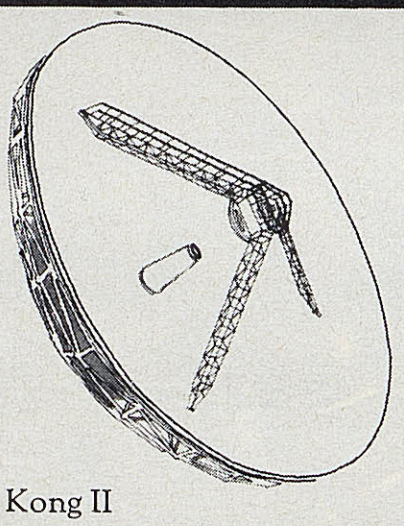

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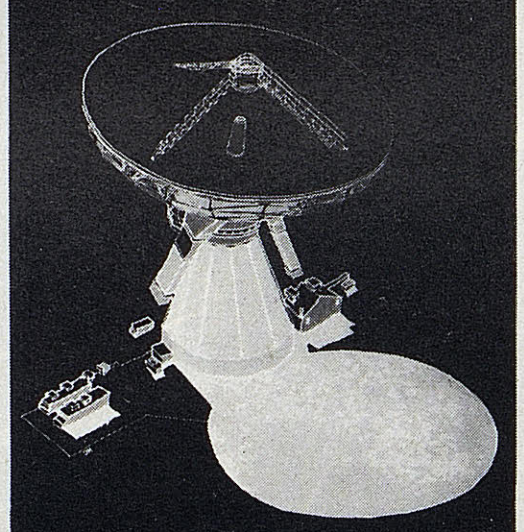

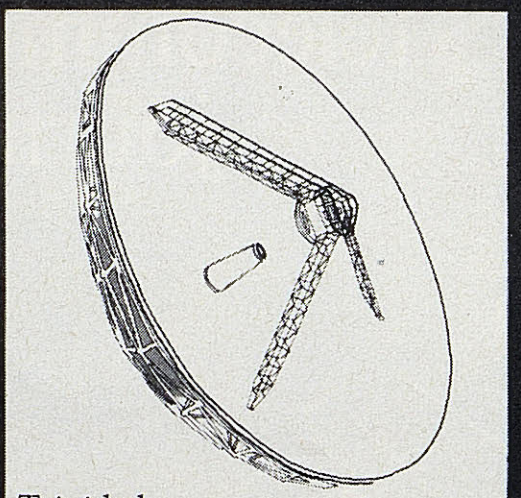

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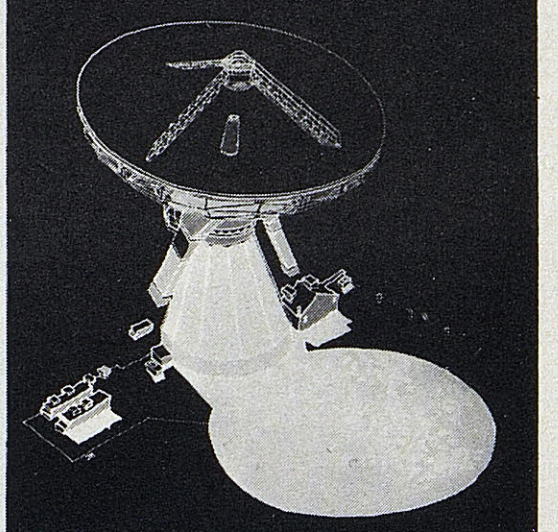

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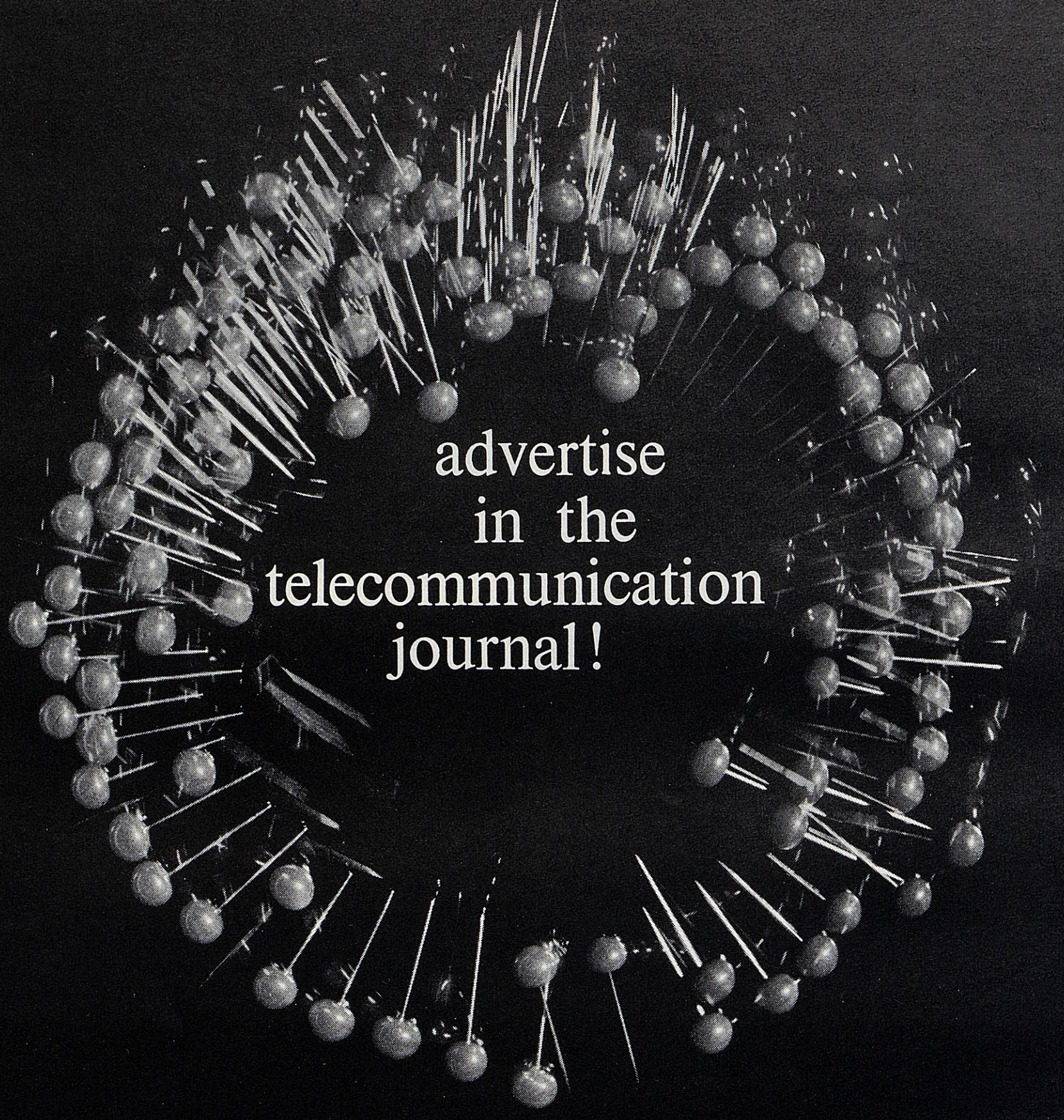

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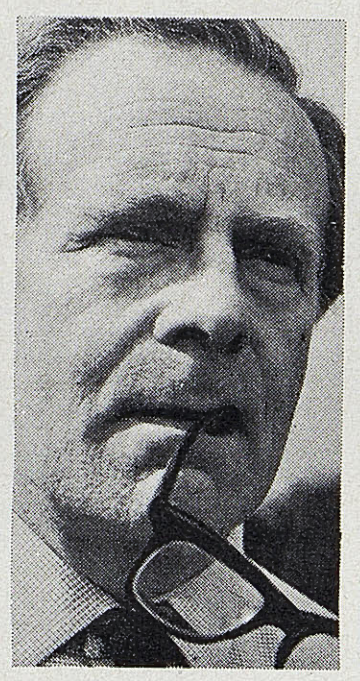
Cables: Annoncenservice Zurich

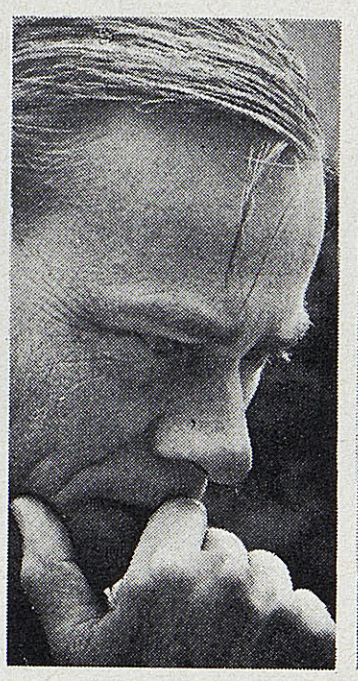
Branch office:
ANNONCES-SERVICE POST SA
En Sallin
CH-1092 Belmont-sur-Lausanne
Phone: 021-28 50 80
Cables: Annoncenservice Zurich

think of GEC·AEI and you think of...

Research
Development
Design

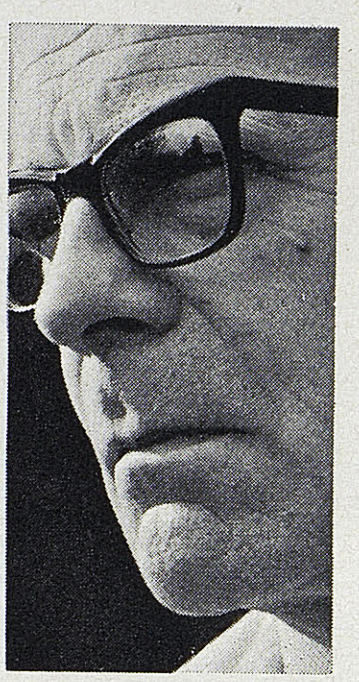


Surveying.
Planning,
Systems Design,
Installation
Commissioning

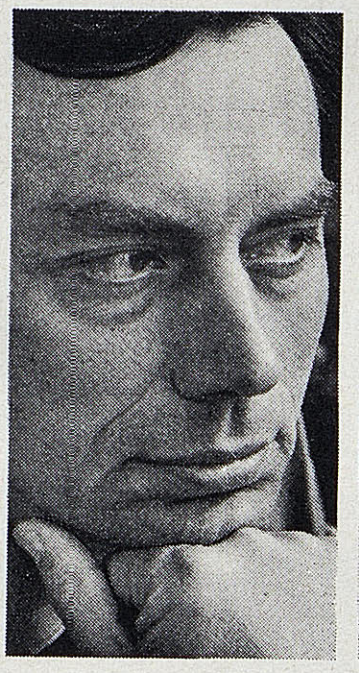


Transmission by
Radio, Cable and
Open-Wire Line

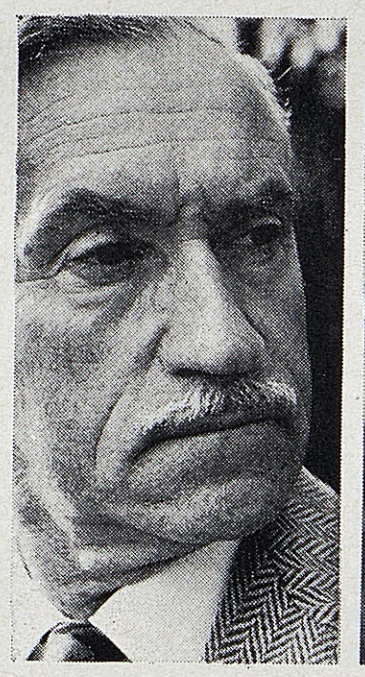
Frequency Division
and Digital
Multiplex



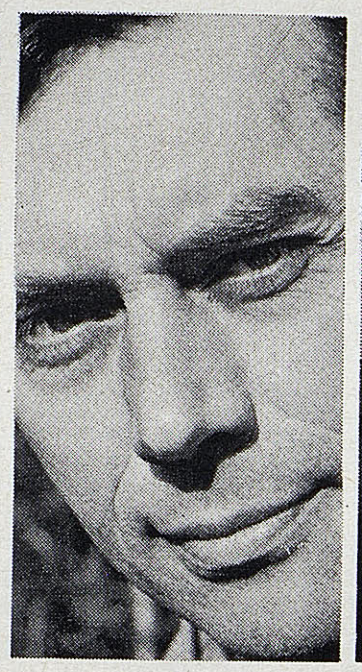
Audio, Programme,
Signalling
Telegraph and Data
Equipment



Public Exchanges
Trunk Switching
RAX-UAX
Mobile Exchanges



PABX-PAX
Private Telephone
Systems



Telephones
Table, Wall,
Secretarial,
Loudspeaking

Maintenance
Training

International
Representation

...a complete telecommunications service

GEC-AEI Telecommunications Limited is a management company responsible for the telecommunications interests of The General Electric Co. Ltd. of England and Associated Electrical Industries Ltd.
The largest company in this field in England, and one of the largest in the world, GEC-AEI combines a vast research, development and manufacturing capability to provide a complete telecommunications service.

G.E.C.

Takes telecommunications into tomorrow

GEC-AEI TELECOMMUNICATIONS LTD, OF COVENTRY, ENGLAND.

A Management Company of The General Electric Co. Ltd. of England.

IB/35A

man needs to communicate
we make what communications need

telephone exchange equipment
radio communication equipment
auto radios and car stereo (ten)
numerical control equipment (fanuc)
carrier transmission equipment
space electronics systems
equipment (facom)
remote control and telemetering equipment
electronic computers and peripheral
telegraph and data communication equipment
electronic components

FUJITSU LIMITED
Communications and Electronics
Marunouchi, Tokyo, Japan

Our background in computer science and technology makes us a rara avis amongst communications specialists, and our sophisticated data communications networks would have been called a dream of science fiction a few years ago. But they have become reality, and now their capabilities extend to helping with traffic control on land and sea, sufficient and steady water supply for power stations, closed-tv educational programs, agricultural and aquacultural research and planning, environmental and pollution control -- short, they can help all of us to live better and perform our tasks more efficiently.

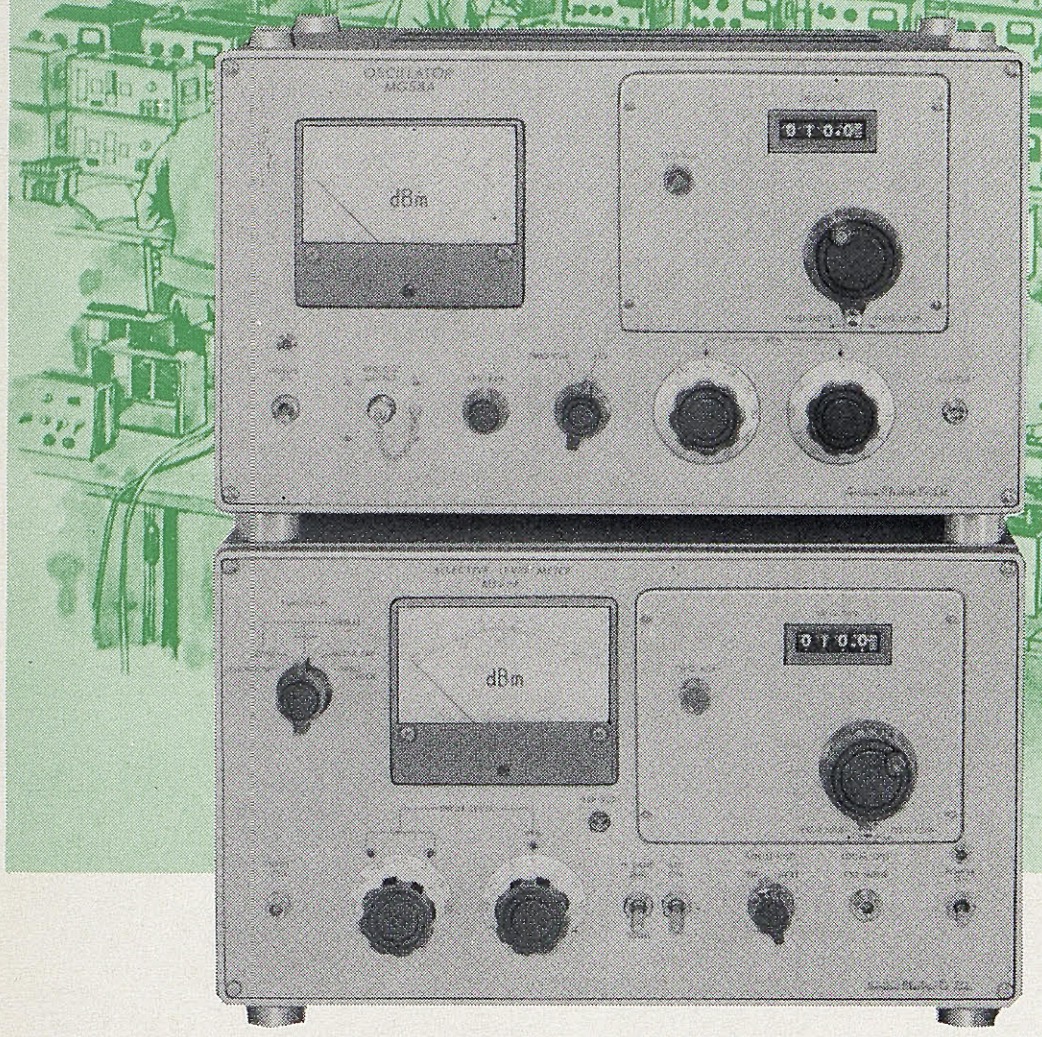
Which is the basic task of all communications systems.

1—150MHz

Anritsu Guarantees Efficient Measurement Over This Entire Range.

Oscillator MG58A

Selective Level Meter ML55A



This equipment is newly developed for measuring ultra-super wide frequency band transmission characteristics and carries out various types of measurements efficiently over the entire range of 1—150MHz, since frequency-ganging is possible between its oscillator and selective level meter and frequency selection can automatically be made as required simply by means of establishing frequency of the oscillator.

The new international standard succeeding the current 2,700-channel system will be a 10,800-channel system, the upper limit frequency of which will be around 60MHz. Anritsu's ultra-super wide frequency band measuring instrument series, composed of MG58A Oscillator, ML55A Selective Level Meter and other instruments,* more than cope with the 60MHz transmission system of the future.

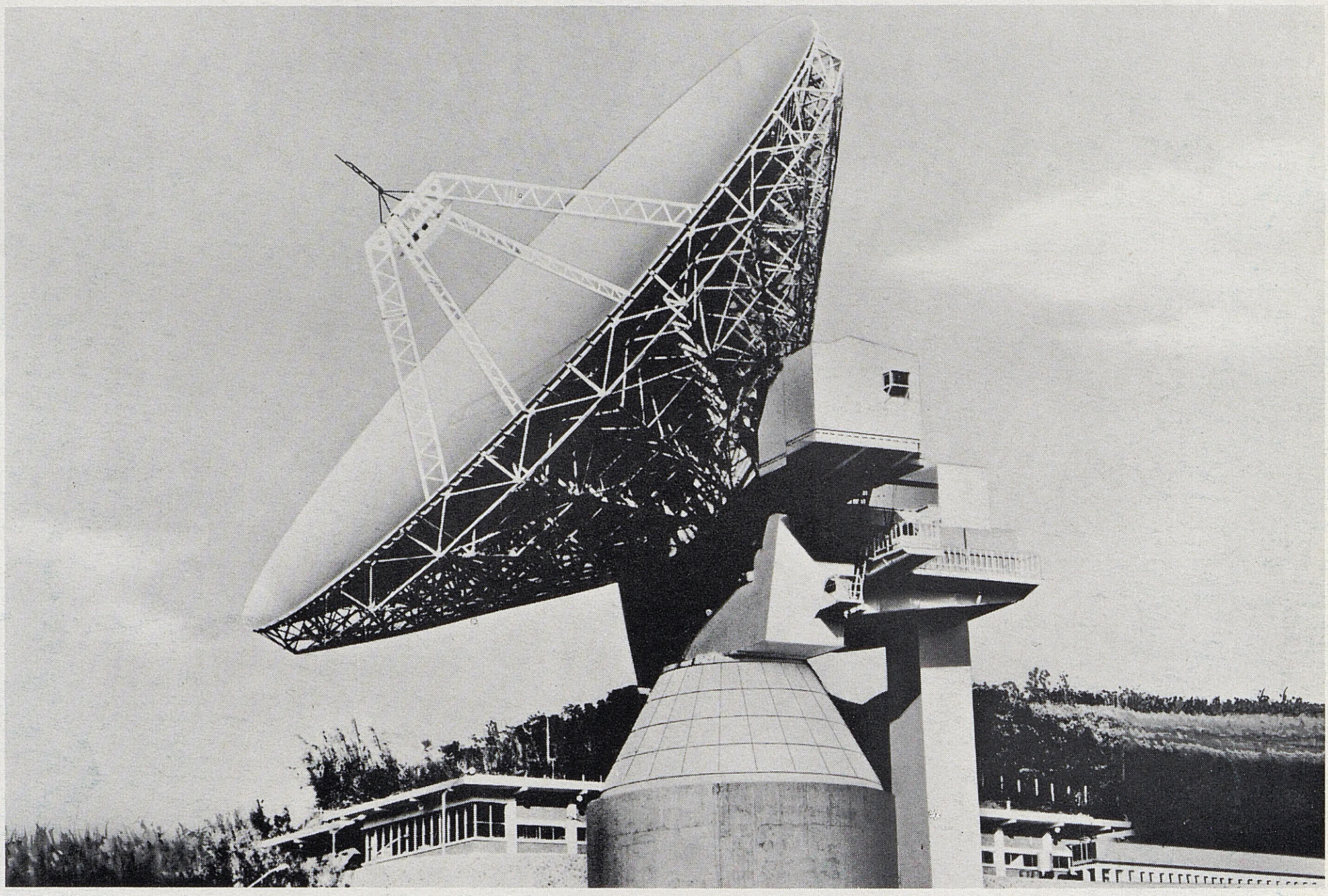
*ML52A	Standard Level Meter	MN53A	Key Box
ML54A	Level Meter	MN54A	Attenuator
MN51A	Low-pass Filter	MR51A	Return Loss Measuring Set
MN52A	High-pass Filter		

Anritsu

Anritsu Electric Co., Ltd.

4-12-20, Minamiazabu, Minato-ku, Tokyo, Japan Phone: 446-1111 Telex: 0242-2353 (ANRITSU TOK) Cable: ANRITDENKI TOKYO

25 Satellite Communications Earth Stations by NEC— With 3 more now going up



The Taipei earth station antenna shown above can withstand heavy typhoon winds of over 210 miles per hour.

It's a small world we're living in these days—and it's getting smaller all the time. NEC satellite communications equipment operating on opposite sides of the globe is bringing people closer together than anyone would have dreamed possible a few years ago.

NEC has supplied and installed equipment and/or complete earth station systems for no less than 25 earth stations so far; for instance, Peru in July, Kuwait in October, Australian three stations in August, October and November, the Republic of China in December last year. In addition, NEC has been awarded contracts for three more earth stations—Jordan, New Zealand, and Singapore.

The commanding position currently held by NEC is vivid evidence of its technical superiority, exemplified in such NEC-designed subsystem equipment as antennas, low-noise receivers and threshold extension demodulators.

As one of the most comprehensive manufacturers of electronics and telecommunications equipment, NEC is fully geared to cope with the present progress of worldwide satellite communication systems. And as for the exciting possibilities of the future offered by the great expanse that lies beyond this shrinking world of ours, NEC has the space to develop.

Products for today—
Innovations for tomorrow

NEC

Nippon Electric Co., Ltd.
Tokyo, Japan

Overseas Offices: Taipei, Manila, Bangkok, Djakarta, Kuala Lumpur, New Delhi, Karachi, Teheran, Beirut, Melbourne, Düsseldorf, Mexico City, Rio de Janeiro, Bogotá, New York, Chicago, Los Angeles, Washington.

Main Products: electronic computers, data communication systems, telephone systems, carrier transmission equipment, radio communication systems, radio & television broadcasting equipment, satellite communications equipment, electrical household appliances, other applied electronic equipment, and electronic components.